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(12) **United States Patent**
Goran et al.

(10) **Patent No.: US 11,392,580 B2**
(45) **Date of Patent: Jul. 19, 2022**

(54) **METHODS, SYSTEMS, AND MEDIA FOR RECOMMENDING COMPUTERIZED SERVICES BASED ON AN ANIMATE OBJECT IN THE USER'S ENVIRONMENT**

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(73) Assignee: **Google LLC**, Mountain View, CA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 576 days.

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(51) **Int. Cl.**
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G06F 16/24 (2019.01)
(Continued)

(52) **U.S. Cl.**
CPC ***G06F 16/24*** (2019.01); ***G06F 3/011*** (2013.01); ***G06F 3/017*** (2013.01); ***G06F 3/0346*** (2013.01);
(Continued)

(58) **Field of Classification Search**
CPC G06F 17/30386; G06F 3/011; G06F 3/015; G06F 2203/011; G06F 22/011; G06N 99/005
See application file for complete search history.

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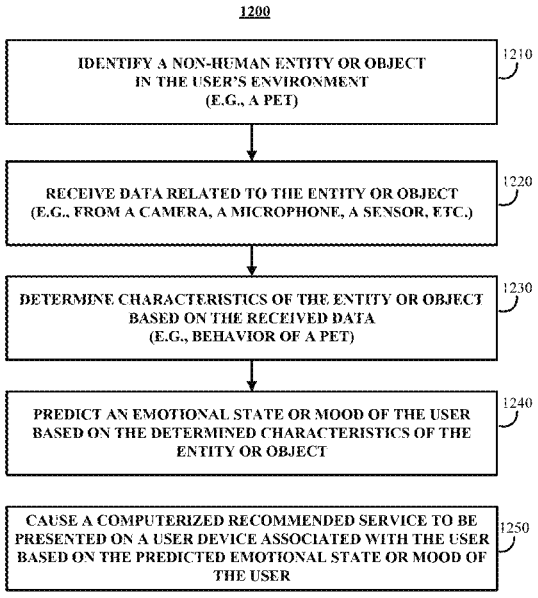
Primary Examiner — Hasanul Mobin
(74) *Attorney, Agent, or Firm* — Byrne Poh LLP

(57) **ABSTRACT**

Methods, systems, and media for recommending computerized services based on an animate object in the user's environment are provided. In some implementations, the method comprises: receiving a request from a user device to associate a recording device that captures motion data indicative of motion of an animate object in proximity to the user device; associating the user device with the recording device in response to receiving the request; receiving the motion data from the recording device that is indicative of motion of the animate object; determining characteristics of the animate object based on the received motion data; correlating an emotional state of a user of the user device based on the determined characteristics associated with the animate object; and causing a recommended computerized service to be presented by the user device based on the emotional state of the user.

21 Claims, 14 Drawing Sheets



(51) **Int. Cl.**
G06F 3/01 (2006.01)
G06N 20/00 (2019.01)
G06F 3/0346 (2013.01)

(52) **U.S. Cl.**
CPC ***G06N 20/00*** (2019.01); *G06F 2203/011* (2013.01)

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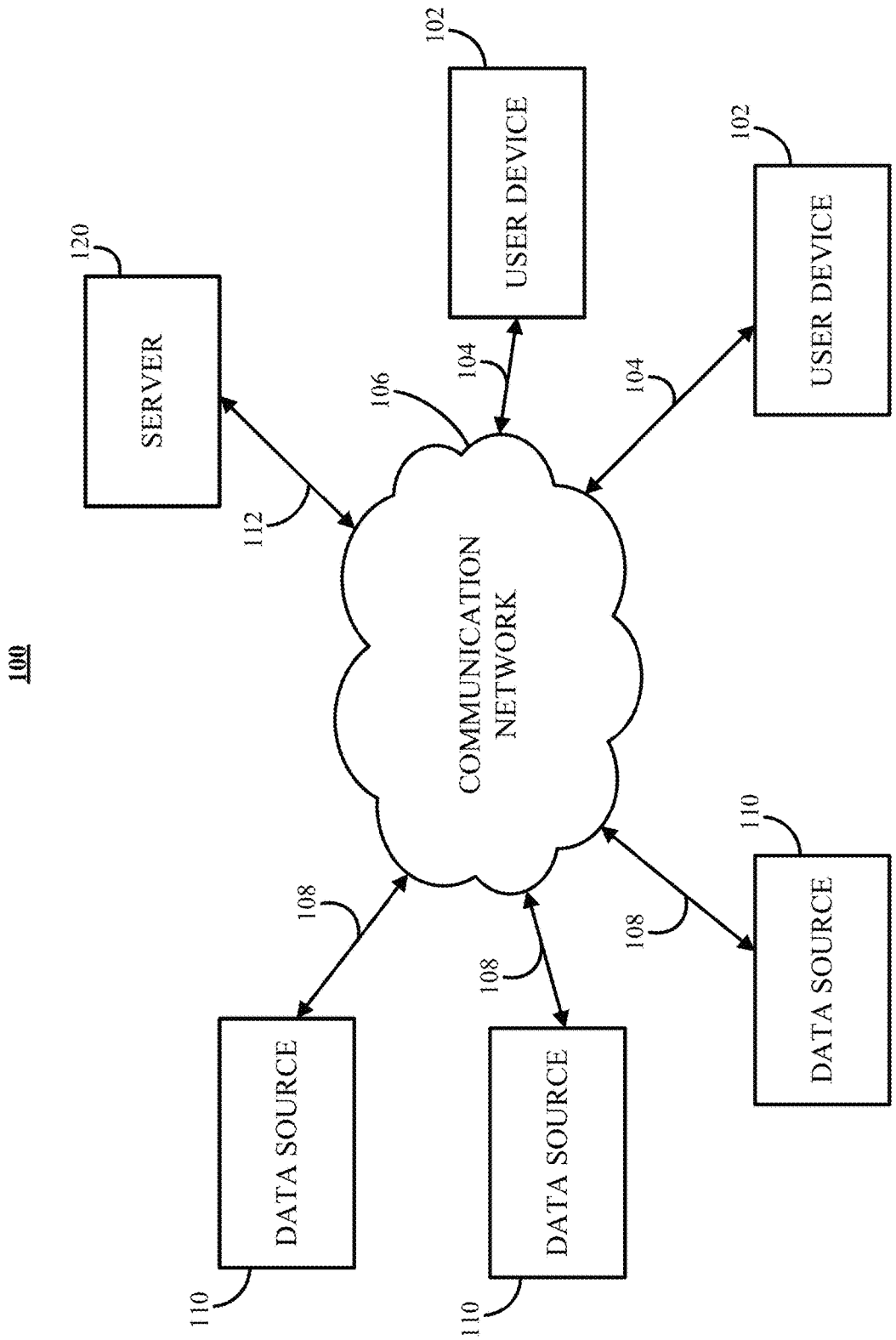
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108
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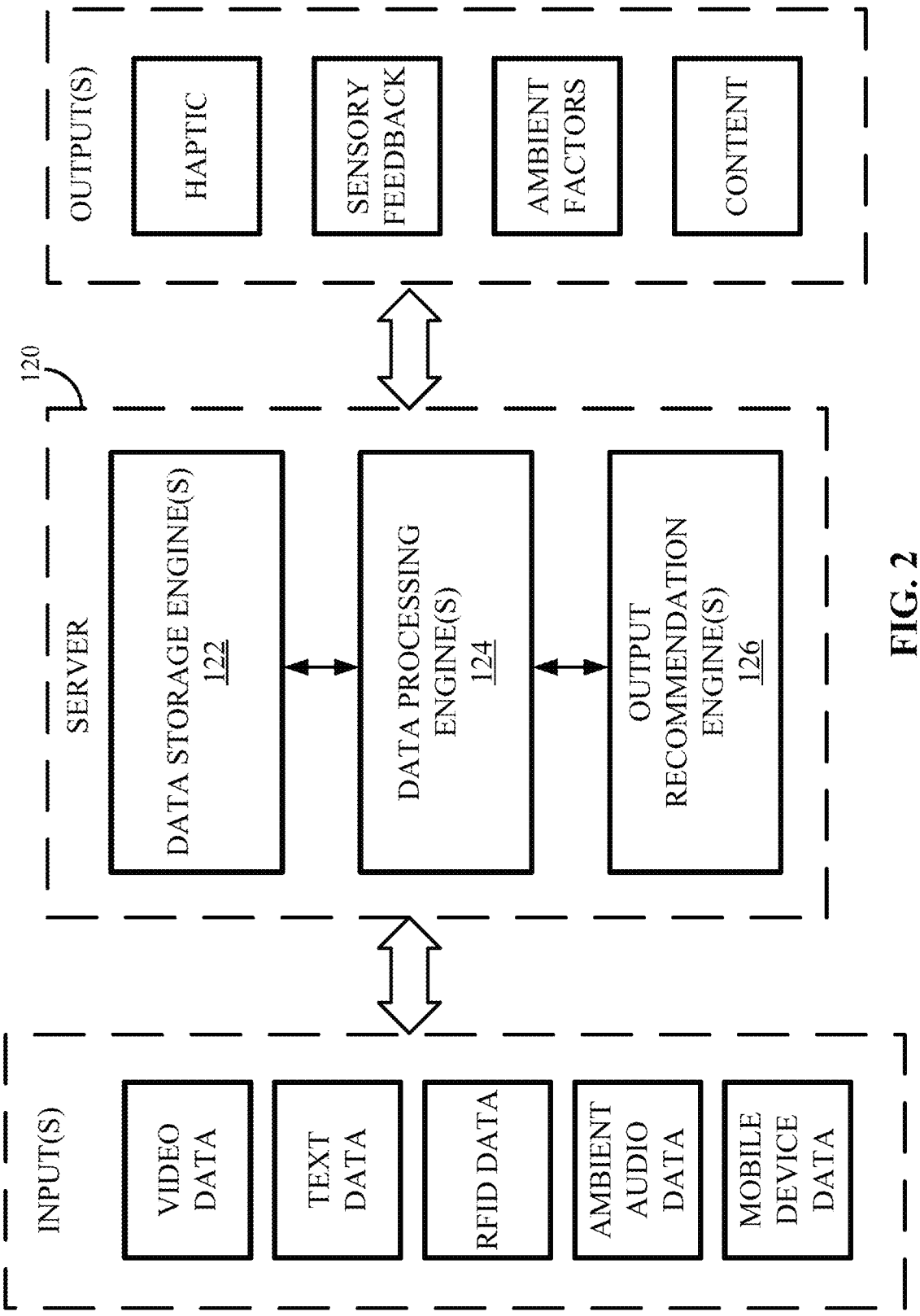
DATA SOURCE
110
DATA SOURCE
110
DATA SOURCE
110

FIG. 1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SENSORY FEEDBACK
AMBIENT FACTORS
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DATA PROCESSING ENGINE(S) 124
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INPUT(S)
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RFID DATA
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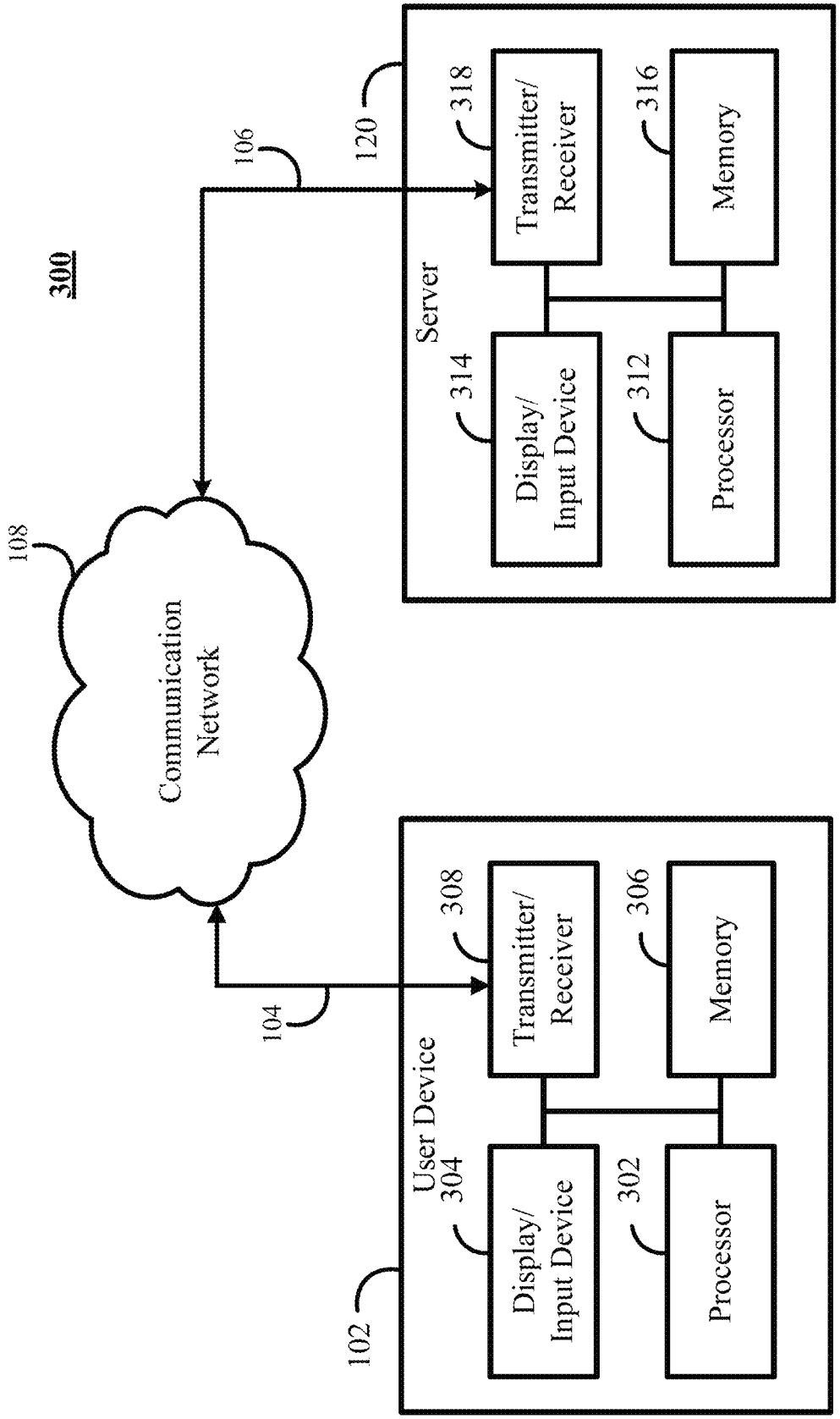
MOBILE DEVICE DATA

FIG. 2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Communication Network
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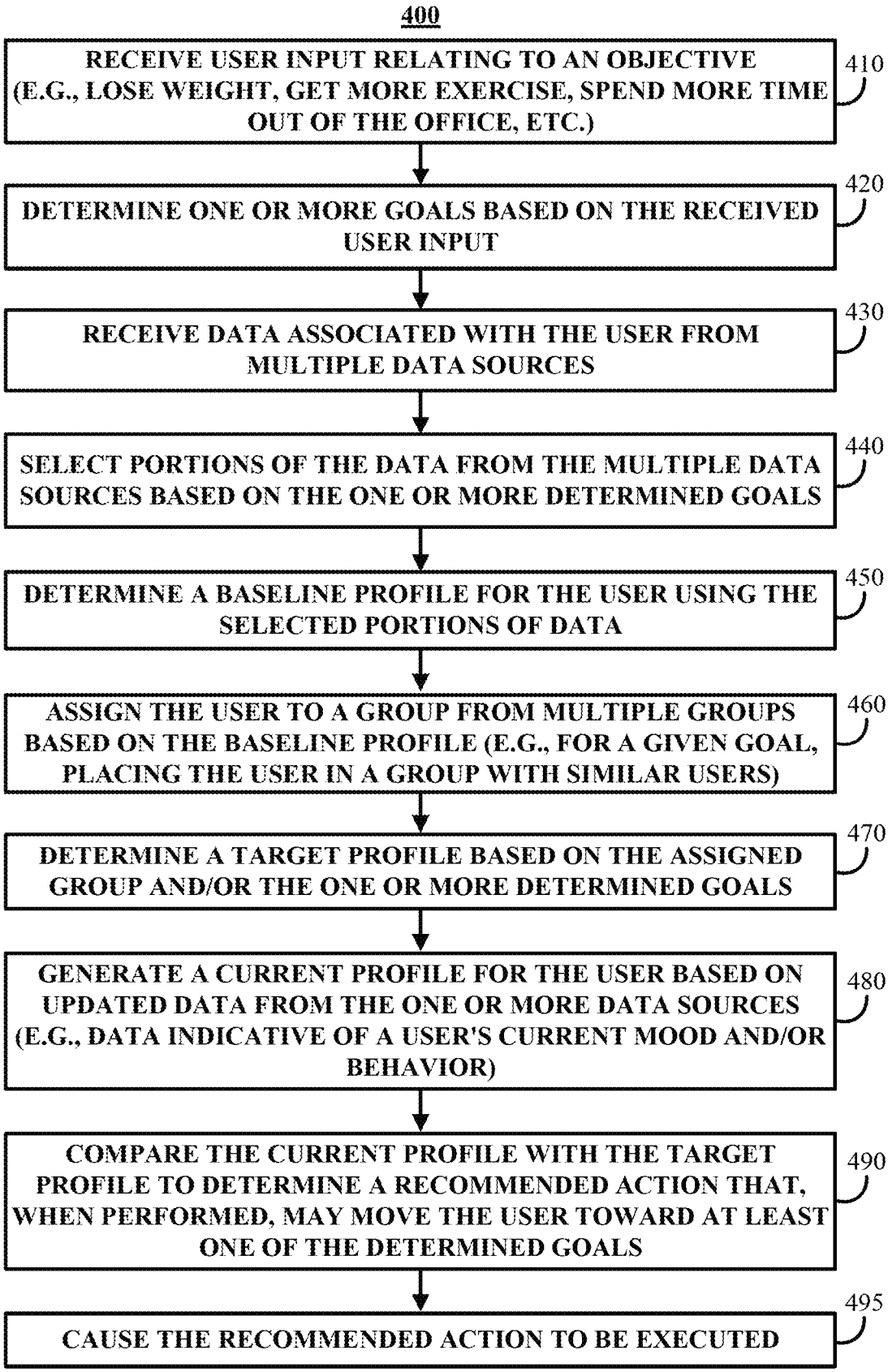
106
104
120
Server
Transmitter/ Receiver
318
Memory
316
Display/ Input Device
314
Processor
312
User Device
102
Transmitter/ Receiver
308
Memory
306
Display/ Input Device
304
Processor
302

FIG. 3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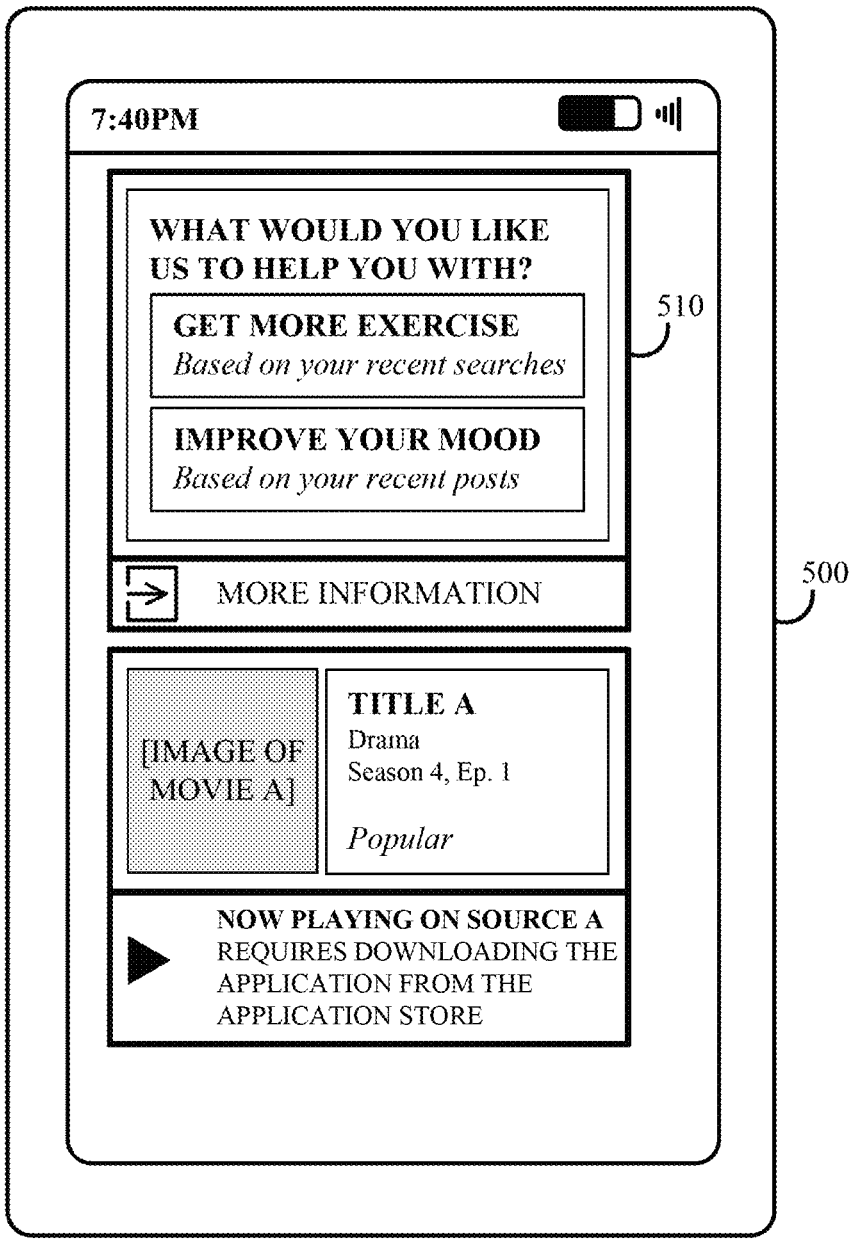
RECEIVE USER INPUT RELATING TO AN OBJECTIVE (E.G., LOSE WEIGHT, GET MORE EXERCISE, SPEND MORE TIME OUT OF THE OFFICE, ETC.)
410
DETERMINE ONE OR MORE GOALS BASED ON THE RECEIVED USER INPUT
420
RECEIVE DATA ASSOCIATED WITH THE USER FROM MULTIPLE DATA SOURCES
430
SELECT PORTIONS OF THE DATA FROM THE MULTIPLE DATA SOURCES BASED ON THE ONE OR MORE DETERMINED GOALS
440
DETERMINE A BASELINE PROFILE FOR THE USER USING THE SELECTED PORTIONS OF DATA
450
ASSIGN THE USER TO A GROUP FROM MULTIPLE GROUPS BASED ON THE BASELINE PROFILE (E.G., FOR A GIVEN GOAL, PLACING THE USER IN A GROUP WITH SIMILAR USERS)
460
DETERMINE A TARGET PROFILE BASED ON THE ASSIGNED GROUP AND/OR THE ONE OR MORE DETERMINED GOALS
470
GENERATE A CURRENT PROFILE FOR THE USER BASED ON UPDATED DATA FROM THE ONE OR MORE DATA SOURCES (E.G., DATA INDICATIVE OF A USER'S CURRENT MOOD AND/OR BEHAVIOR)
480
COMPARE THE CURRENT PROFILE WITH THE TARGET PROFILE TO DETERMINE A RECOMMENDED ACTION THAT, WHEN PERFORMED, MAY MOVE THE USER TOWARD AT LEAST ONE OF THE DETERMINED GOALS
490
CAUSE THE RECOMMENDED ACTION TO BE EXECUTED
495

FIG. 4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Based on your recent searches
IMPROVE YOUR MOOD
Based on your recent posts
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MORE INFORMATION
[IMAGE OF MOVIE A]
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Drama
Season 4, Ep. 1
Popular
NOW PLAYING ON SOURCE A
REQUIRES DOWNLOADING THE APPLICATION FROM THE APPLICATION STORE
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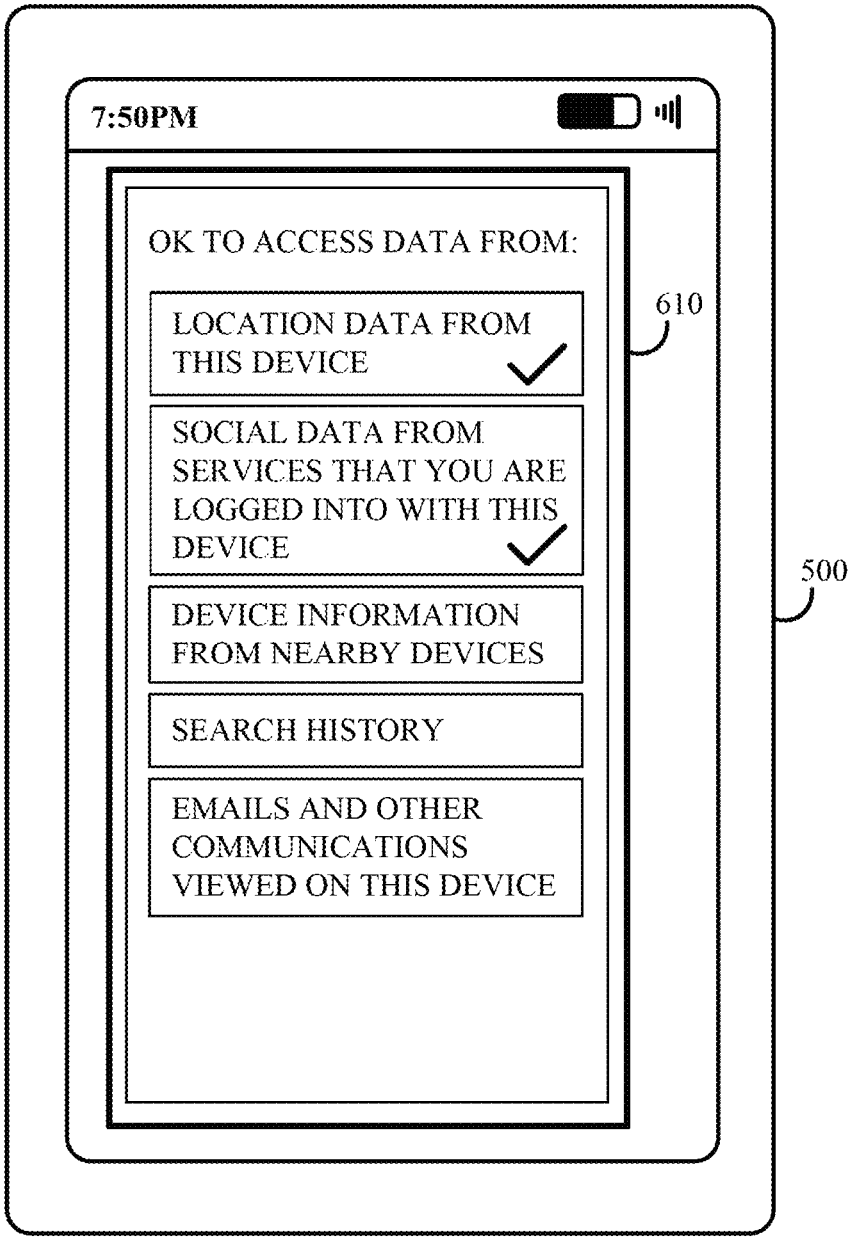
FIG. 5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OK TO ACCESS DATA FROM:
LOCATION DATA FROM THIS DEVICE
SOCIAL DATA FROM SERVICES THAT YOU ARE LOGGED INTO WITH THIS DEVICE
DEVICE INFORMATION FROM NEARBY DEVICES
SEARCH HISTORY
EMAILS AND OTHER COMMUNICATIONS VIEWED ON THIS DEVICE
610
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FIG. 6

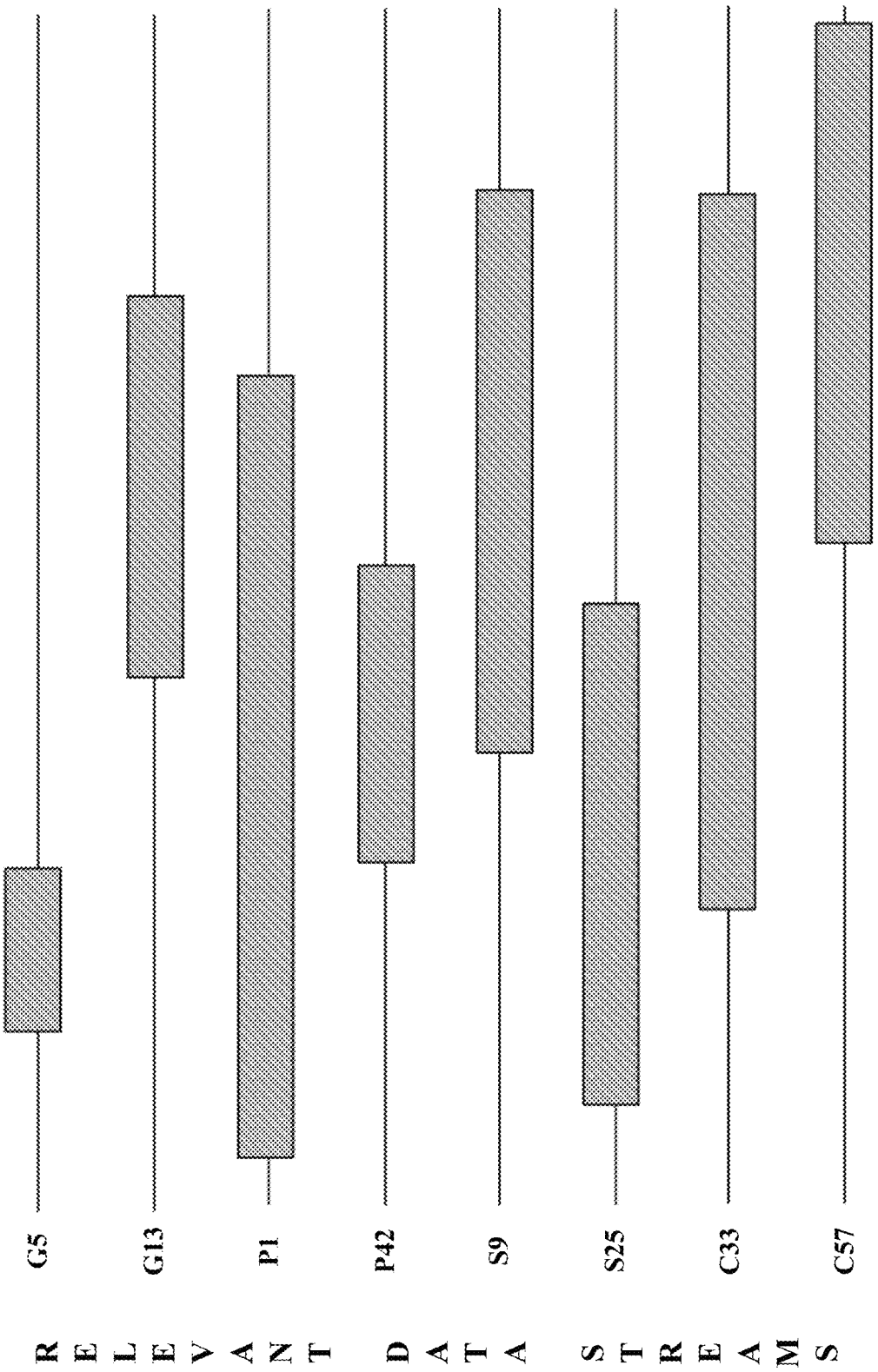

FIG. 7

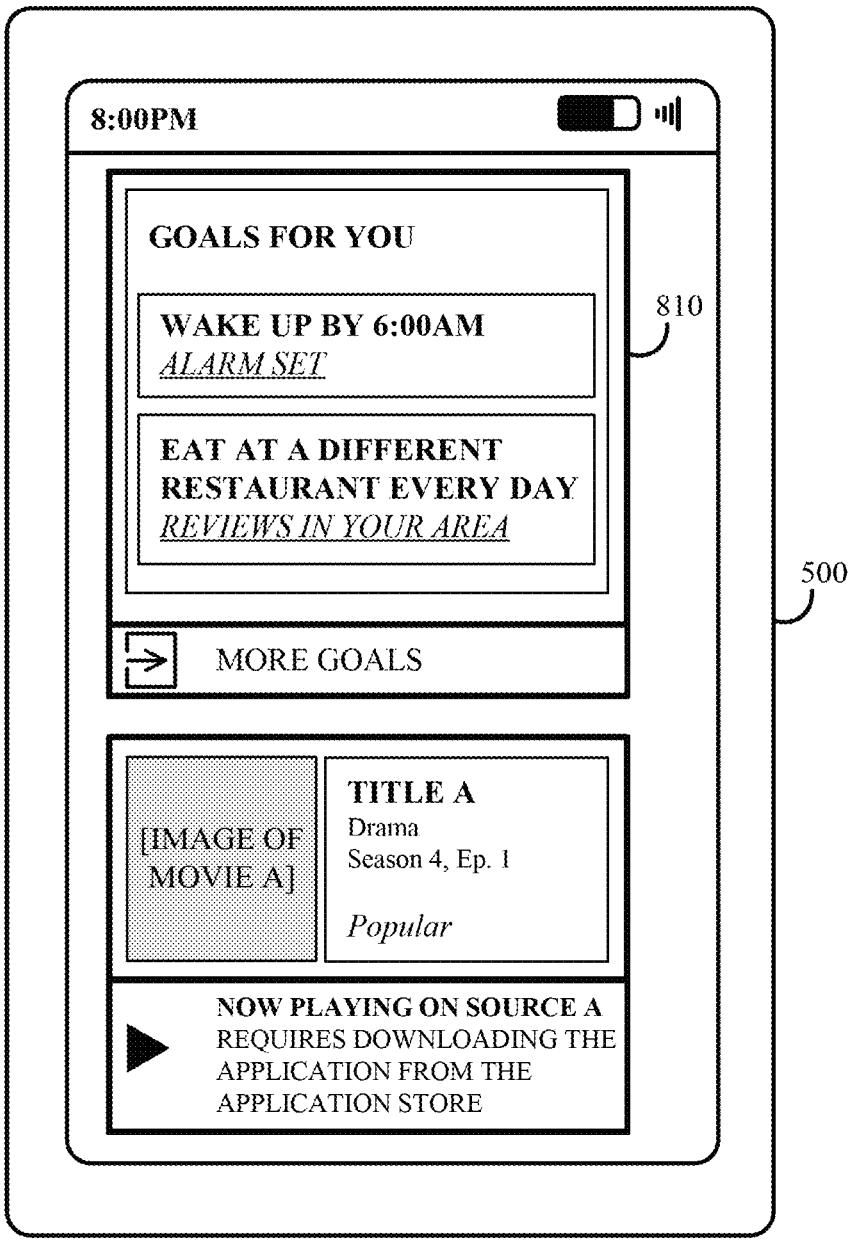
8:00PM
GOALS FOR YOU
WAKE UP BY 6:00AM
ALARM SET
EAT AT A DIFFERENT RESTAURANT EVERY DAY
REVIEWS IN YOUR AREA
810
MORE GOALS
[IMAGE OF MOVIE A]
TITLE A
Drama
Season 4, Ep. 1
Popular
NOW PLAYING ON SOURCE A
REQUIRES DOWNLOADING THE APPLICATION FROM THE APPLICATION STORE
500

FIG. 8

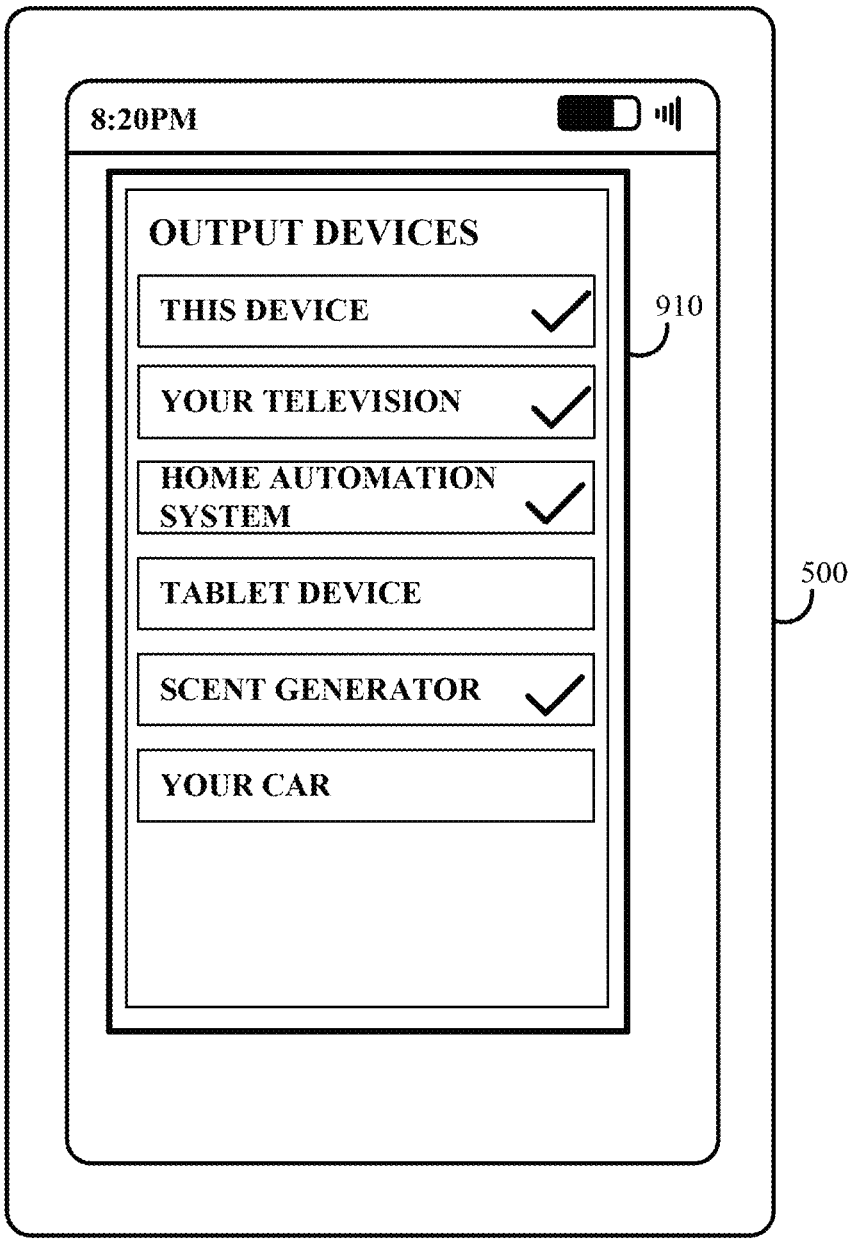
8:20PM
OUTPUT DEVICES
THIS DEVICE
YOUR TELEVISION
HOME AUTOMATION SYSTEM
TABLET DEVICE
SCENT GENERATOR
YOUR CAR
910
500

FIG. 9

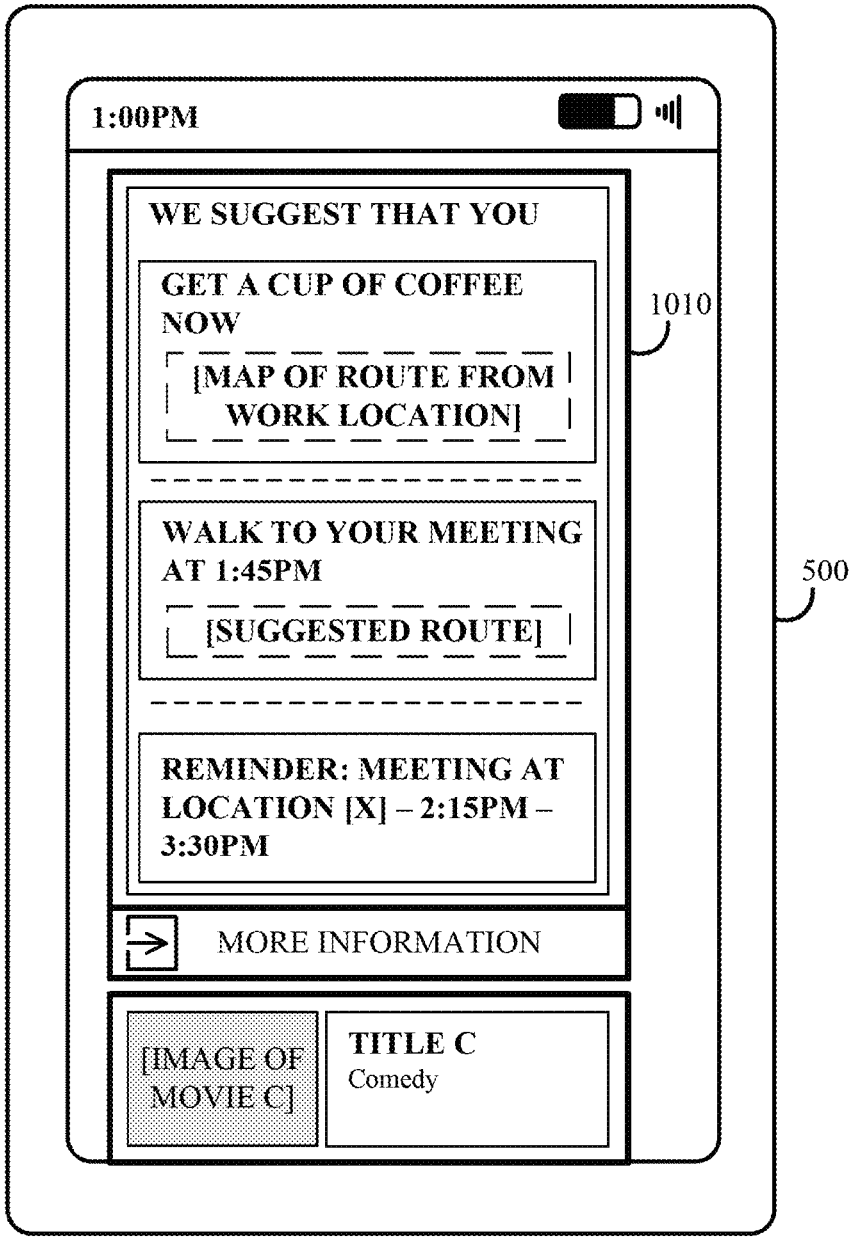
1:00PM
WE SUGGEST THAT YOU
GET A CUP OF COFFEE NOW
[MAP OF ROUTE FROM WORK LOCATION]
1010
WALK TO YOUR MEETING AT 1:45PM
[SUGGESTED ROUTE]
REMINDER: MEETING AT LOCATION [X] – 2:15PM – 3:30PM
MORE INFORMATION
[IMAGE OF MOVIE C]
TITLE C
Comedy
500

FIG. 10

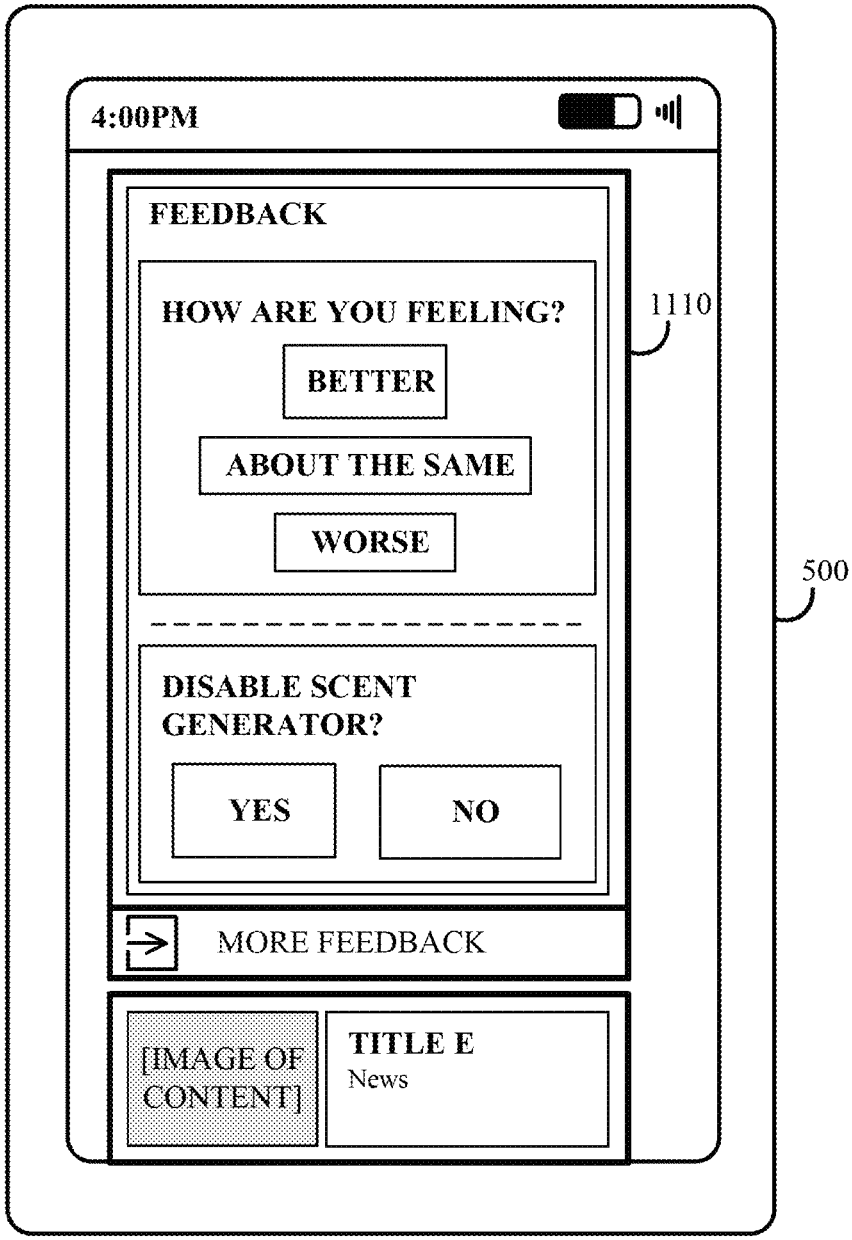
4:00PM
FEEDBACK
HOW ARE YOU FEELING?
BETTER
ABOUT THE SAME
WORSE
1110
DISABLE SCENT GENERATOR?
YES
NO
MORE FEEDBACK
[IMAGE OF CONTENT]
TITLE E
News
500

FIG. 11

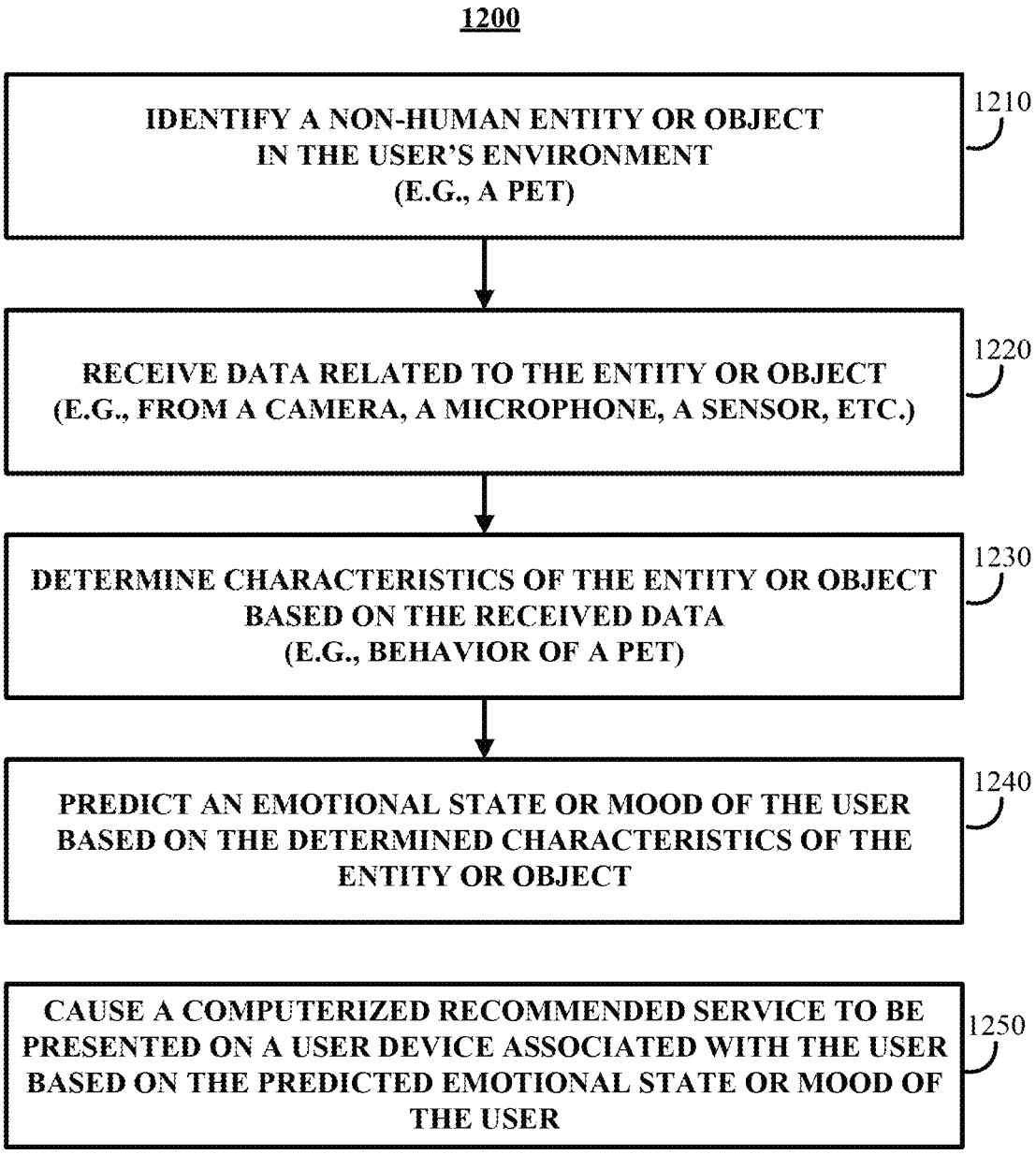
1200
IDENTIFY A NON-HUMAN ENTITY OR OBJECT IN THE USER'S ENVIRONMENT (E.G., A PET)
1210
RECEIVE DATA RELATED TO THE ENTITY OR OBJECT (E.G., FROM A CAMERA, A MICROPHONE, A SENSOR, ETC.)
1220
DETERMINE CHARACTERISTICS OF THE ENTITY OR OBJECT BASED ON THE RECEIVED DATA (E.G., BEHAVIOR OF A PET)
1230
PREDICT AN EMOTIONAL STATE OR MOOD OF THE USER BASED ON THE DETERMINED CHARACTERISTICS OF THE ENTITY OR OBJECT
1240
CAUSE A COMPUTERIZED RECOMMENDED SERVICE TO BE PRESENTED ON A USER DEVICE ASSOCIATED WITH THE USER BASED ON THE PREDICTED EMOTIONAL STATE OR MOOD OF THE USER
1250

FIG. 12

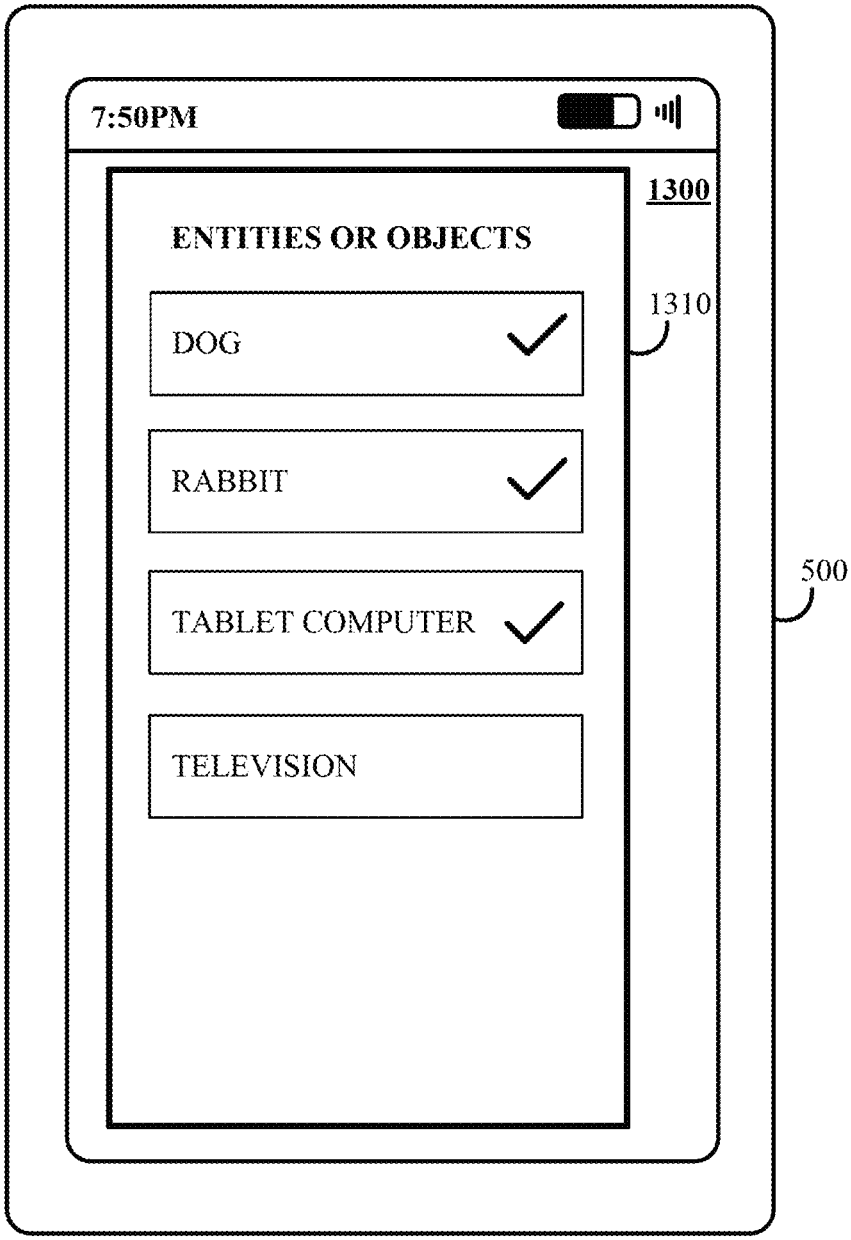
7:50PM
1300
ENTITIES OR OBJECTS
1310
DOG
RABBIT
TABLET COMPUTER
TELEVISION
500

FIG. 13

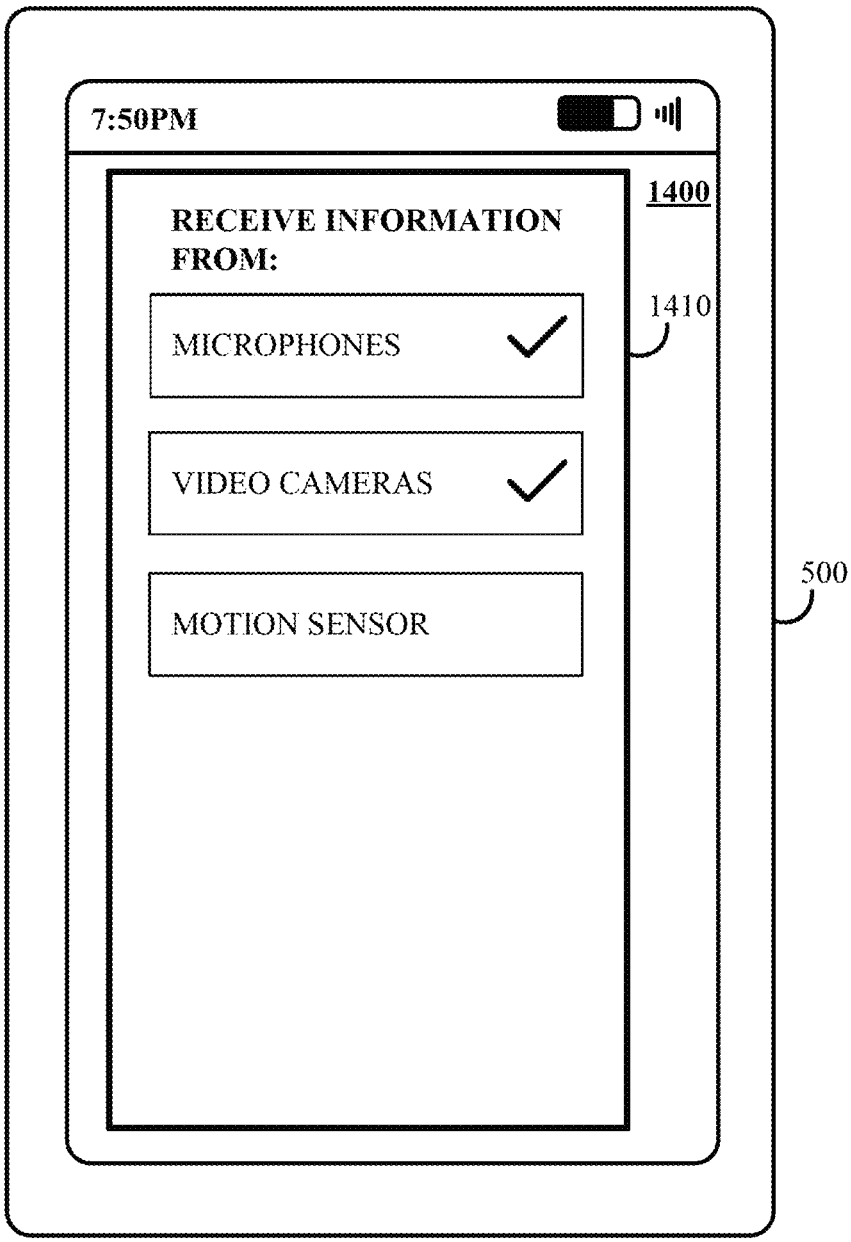
7:50PM
1400
RECEIVE INFORMATION FROM:
1410
MICROPHONES
VIDEO CAMERAS
MOTION SENSOR
500

FIG. 14

METHODS, SYSTEMS, AND MEDIA FOR RECOMMENDING COMPUTERIZED SERVICES BASED ON AN ANIMATE OBJECT IN THE USER'S ENVIRONMENT

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is related to U.S. patent application Ser. No. 14/619,827, entitled "METHODS, SYSTEMS, AND MEDIA FOR AMBIENT BACKGROUND NOISE MODIFICATION BASED ON MOOD AND/OR BEHAVIOR INFORMATION,", U.S. patent application Ser. No. 14/619,866, entitled "METHODS, SYSTEMS, AND MEDIA FOR PRODUCING SENSORY OUTPUTS CORRELATED WITH RELEVANT INFORMATION,", U.S. patent application Ser. No. 14/619,894, entitled "METHODS, SYSTEMS, AND MEDIA FOR PRESENTING INFORMATION RELATED TO AN EVENT BASED ON METADATA,", U.S. patent application Ser. No. 14/619,843, entitled "METHODS, SYSTEMS, AND MEDIA FOR PRESENTING CONTEXTUALLY RELEVANT INFORMATION,", and U.S. patent application Ser. No. 14/619,863, entitled "METHODS, SYSTEMS, AND MEDIA FOR PERSONALIZING COMPUTERIZED SERVICES BASED ON MOOD AND/OR BEHAVIOR INFORMATION FROM MULTIPLE DATA SOURCES,", all of which were filed on even date herewith and incorporated by reference herein in their entireties.

TECHNICAL FIELD

The disclosed subject matter relates to methods, systems, and media for recommending computerized services based on an animate object in the user's environment.

BACKGROUND

Devices, such as smartphones, tablet computers, and wearable computers, are becoming ubiquitous and indispensable tools used by many users to access information from a wide variety of technology-based services, such as search engines, social networking sites, and e-commerce sites. Moreover, users of these devices can use one or more of these technology-based services to enter information that may provide information relating to a particular user's activities and concerns. In addition, some users can use one or more of these technology-based services to enter information that may provide a portrait of the user's tastes, affinities, preferences, and the like. Despite accessing and/or entering information relating to a user in these various services, it is difficult for the user to harness this information across various services and, more particularly, use such information to assist the user in making decisions and/or assessments.

Accordingly, it is desirable to provide methods, systems, and media for recommending computerized services based on an animate object in the user's environment.

SUMMARY

In accordance with some implementations of the disclosed subject matter, methods, systems, and media for recommending computerized services based on an animate object in the user's environment are provided.

In accordance with some implementations of the disclosed subject matter, a method for recommending computerized services based on an animate object in the user's environment is provided, the method comprising: receiving a request from a user device to associate a recording device that captures motion data indicative of motion of an animate object in proximity to the user device; associating the user device with the recording device in response to receiving the request; receiving the motion data from the recording device that is indicative of motion of the animate object; determining, using a hardware processor, characteristics of the animate object based on the received motion data; correlating an emotional state of a user of the user device based on the determined characteristics associated with the animate object; and causing a recommended computerized service to be presented by the user device based on the emotional state of the user.

In accordance with some implementations of the disclosed subject matter, a system for recommending computerized services based on an animate object in the user's environment is provided, the system comprising: a hardware processor that is programmed to: receive a request from a user device to associate a recording device that captures motion data indicative of motion of an animate object in proximity to the user device; associate the user device with the recording device in response to receiving the request; receive the motion data from the recording device that is indicative of motion of the animate object; determine characteristics of the animate object based on the received motion data; correlate an emotional state of a user of the user device based on the determined characteristics associated with the animate object; and cause a recommended computerized service to be presented by the user device based on the emotional state of the user.

In accordance with some implementations of the disclosed subject matter, a non-transitory computer-readable medium containing computer-executable instructions that, when executed by a processor, cause the processor to perform a method for recommending computerized services based on an animate object in the user's environment is provided, the method comprising: receiving a request from a user device to associate a recording device that captures motion data indicative of motion of an animate object in proximity to the user device; associating the user device with the recording device in response to receiving the request; receiving the motion data from the recording device that is indicative of motion of the animate object; determining characteristics of the animate object based on the received motion data; correlating an emotional state of a user of the user device based on the determined characteristics associated with the animate object; and causing a recommended computerized service to be presented by the user device based on the emotional state of the user.

In accordance with some implementations of the disclosed subject matter, a system for recommending computerized services based on an animate object in the user's environment is provided, the system comprising: means for receiving a request from a user device to associate a recording device that captures motion data indicative of motion of an animate object in proximity to the user device; means for associating the user device with the recording device in response to receiving the request; means for receiving the motion data from the recording device that is indicative of motion of the animate object; means for determining characteristics of the animate object based on the received motion data; means for correlating an emotional state of a user of the user device based on the determined characteristics associated with the animate object; and means for

causing a recommended computerized service to be presented by the user device based on the emotional state of the user.

In some implementations, the recording device is a device having an accelerometer, and the motion data is data received from the accelerometer.

In some implementations, the recording device is a camera, and the motion data includes image data received from the camera.

In some implementations, the means for correlating the emotional state of the user of the user device based on the determined characteristics associated with the animate object further comprises means for accessing a table associated with the user device to determine the emotional state of the user.

In some implementations, the system further comprises: means for receiving, from the user device, information indicating a response to the presented recommended computerized service; and means for updating information user to correlate the emotional state of the user of the user device based on the information indicating the response.

In some implementations, the information indicating the response includes location data associated with the user device.

In some implementations, the information indicating the response is received via a user interface.

BRIEF DESCRIPTION OF THE DRAWINGS

Various objects, features, and advantages of the disclosed subject matter can be more fully appreciated with reference to the following detailed description of the disclosed subject matter when considered in connection with the following drawings, in which like reference numerals identify the like elements.

FIG. **1** shows an example of a generalized schematic diagram of a system on which the mechanisms for personalizing computerized services based on mood and/or behavior information from multiple data sources in accordance with some implementations of the disclosed subject matter.

FIG. **2** shows a more particular example of a server of FIG. **1** that can receive various types of data from multiple data sources and that can recommend various types of actions based on a portion of the received data to various user devices associated with a user device in accordance with some implementations of the disclosed subject matter.

FIG. **3** shows a detailed example of hardware that can be used to implement one or more of the user devices and servers depicted in FIG. **1** in accordance with some implementations of the disclosed subject matter.

FIG. **4** shows an illustrative example of a process for personalizing computerized services based on mood and/or behavior information from multiple data sources in accordance with some implementations of the disclosed subject matter.

FIG. **5** shows an illustrative example of a user interface for prompting the user of the user device to provide an objective in accordance with some implementations of the disclosed subject matter.

FIG. **6** shows an illustrative example of a user interface for prompting the user of the user device to select one or more data sources for retrieving data relating to the user in accordance with some implementations of the disclosed subject matter.

FIG. **7** shows an illustrative example of a portion of data at various times selected from the data that is received from multiple data sources based on a particular objective or goal in accordance with some implementations of the disclosed subject matter.

FIG. **8** shows an illustrative example of a user interface for presenting the user with selectable goals corresponding to an objective in accordance with some implementations of the disclosed subject matter.

FIG. **9** shows an illustrative example of a user interface for presenting the user with selectable output devices that can be used to execute a recommended action in accordance with some implementations of the disclosed subject matter.

FIG. **10** shows an illustrative example of a user interface for presenting the user with a recommendation interface that includes a recommended action in accordance with some implementations of the disclosed subject matter.

FIG. **11** shows an illustrative example of a user interface that prompts the user to provide feedback relating to an executed action in accordance with some implementations of the disclosed subject matter.

FIG. **12** shows an example of a process for determining characteristics of an entity or animate object in a user's environment in accordance with some implementations of the disclosed subject matter.

FIG. **13** shows an example of a user interface for receiving selections from a user of entities and/or objects to be analyzed in accordance with some implementations of the disclosed subject matter.

FIG. **14** shows an example of a user interface for receiving selections from a user of sources of information that can be used to analyze characteristics of entities and/or objects in accordance with some implementations of the disclosed subject matter.

DETAILED DESCRIPTION

In accordance with some implementations, as described in more detail below, mechanisms, which can include methods, systems, and/or computer readable media, for personalizing computerized services based on mood and/or behavior information from multiple data sources are provided.

Generally speaking, these mechanisms can receive inputs from a user of a user device relating to a particular objective for that user and, based on received data that relates to the user, can provide personalized and computerized services that may assist the user in reaching that particular objective. For example, the user of the user device may indicate via a user interface a desire to incorporate more exercise during the course of a workday and, based on data relating to the user from one or more data sources for which the user has affirmatively given consent, the mechanisms can recommend one or more actions that may technologically assist the user in reaching the particular objective—e.g., by recommending through an automatic mobile alert or notification that the user walk to the office today based on weather information, scheduling constraints based on an online calendar, and/or traffic and public transportation information received through one or more computer networks; by recommending that the user who has a particular interest in flowers visit a gardening vendor along the user's route as identified by a computer map routing service (e.g., Google Maps); etc.

It should be noted that, additionally or alternatively to receiving an input relating to a particular objective, the mechanisms can receive user feedback and, based on the received user feedback, determine goals for the user. For example, the user may indicate a lack of energy on weekdays via a user interface on the user device and the mechanisms

can interpret such an indication and determine various goals for the user, such as increasing the amount of exercise-related activities. In another example, the user can be provided with an interface that requests the user provides feedback as to the user's general mood, emotional state, and/or behavioral disposition and the mechanisms can determine goals for the user based on the provided feedback. Illustrative examples of goals that can be determined for a user and/or associated with a user device can include reducing stress from a currently indicated stress level, generally losing weight, losing ten pounds, attaining a particular mood or emotional state (e.g., relaxed, lively, etc.), increasing the amount of exercise that the user currently achieves, making more friends, and/or any other suitable goal relating to the user's general mood, emotional state, and/or behavioral disposition.

It should also be noted that, prior to analyzing data relating to the user from multiple data sources, determining a mood, emotional state, and/or behavioral disposition associated with the user, and/or recommending one or more actions to the user, the mechanisms can request (or require) that the user affirmatively provide consent or authorization to perform such determinations. For example, upon loading an application on a mobile device, the application can prompt the user to provide authorization for receiving information from one or more data sources, performing such determinations, and/or recommending one or more actions to the user. In a more particular example, in response to downloading the application and loading the application on the mobile device, the application executing on the mobile device can perform device discovery functions to determine devices that are connected to or nearby the mobile device, such as a media playback device that includes media data (e.g., watch history, recorded media content information, etc.) and/or a scent generator that includes an activity and/or light sensor for obtaining information relating to the environment around the connected mobile device. The application can then present the user with an interface that requests (or requires) that the user affirmatively provide consent to accessing information from these devices by selecting the one or more devices or data sources for receiving information relating to the user that can be used to determine a mood, emotional state, and/or behavioral disposition associated with the user, determine one or more goals or objectives associated with the user, and/or recommend one or more actions that may impact the physical state, emotional state, and/or behavioral disposition associated with the user. Additionally or alternatively, in response to installing the application on the mobile device, the user can be prompted with a permission message that requests (or requires) that the user affirmatively provide consent prior to receiving information from one or more data sources, performing such determinations, and/or recommending one or more actions to the user.

Upon receiving consent and/or authorization, the mechanisms can receive any suitable data relating to the user from multiple data sources. Such data can include contextual data, social data, personal data, etc. For example, the mechanisms can predict a current mood state for the user based on content and/or information published by the user on a social networking service (e.g., using a social networking application on the user device), biometric data associated with the user (e.g., from a wearable computing device associated with a user account), location data associated with the user (e.g., from the user device), a mood and/or behavioral state of an animate object (e.g., a pet) associated with a user (e.g., based on video and/or audio recordings of animate object), and/or any other suitable data indicative of current mood and/or behavior of the user. In another example, the mechanisms can determine particular activities that the user has engaged in, such as attending a social event (e.g., a conference, a party, a sports event, etc. from an online calendar), consuming a media content item (e.g., a video clip, a song, a news article, a webpage, etc.), interacting with a computing device (e.g., a mobile phone, a wearable computing device, a tablet computer, etc.), interacting with an application (e.g., a media playback application, a social networking application, a messaging application, a web browser, etc. on a user device), and/or any other suitable activity. This activity data can, for example, be used to determine reference behaviors associated with the user (e.g., a particular time and portion of the day is typically spent watching videos on a media playback application executing on a mobile device).

In some implementations, based on data relating to the user that is received from one or more data sources for which the user has affirmatively provided consent, the mechanisms can recommend one or more computerized actions that may assist the user in reaching one or more of the objectives and/or goals. For example, the mechanisms can use device discovery functions to determine which output devices for executing the one or more recommended actions are connected to the mobile device or are proximate to the mobile device, such as devices having a speaker that are capable of playing audio content, devices having a display that are capable of presenting video content, lighting systems that are capable of providing a particular lighting scheme, and scent generators that are capable of emitting a particular scent. In response, these mechanisms can transmit instructions to an output device that is capable of executing a recommended action. For example, in response to determining information indicative of the user's general mood, emotional state, and/or behavioral disposition from one or more data sources, the mechanisms can identify one or more activities that, if performed, may move the user towards a particular objective or goal. In this example, the mechanisms can transmit a message or other suitable interface indicating the recommended activities to the mobile device associated with the user.

In a more particular example, in response to receiving social networking data from a social media application that indicates the user may be experiencing low energy levels (e.g., analyzing text from a post using the social media application) and online calendar data that includes scheduling information associated with a user for a given day, the mechanisms can recommend one or more computerized actions to the user that may assist the user in reaching one or more of the determined goals. The mechanisms can review a route to an event listed in the calendar data, where the route has been identified by a computer map routing service, and transmit an interface to be presented on the mobile device associated with the user, where the interface recommends that the user walk to the event and visit a particular juice vendor along the route as identified by a computer map routing service.

Additionally or alternatively to a recommendation interface that includes a message or other suitable content, personalized and computerized services can include a determination that a particular atmosphere should be created that may affect the user's general mood, emotional state, and/or behavioral disposition. In one particular example, the atmosphere can include causing particular content to be automatically played back (e.g., a particular song that is designated as being inspirational to users), causing a news feed of

articles that are designated as positive stories to be presented, causing photographs or other image content that are designated as amusing to users to be presented, and sound effects that are designated as having a relaxing effect on users, to be presented to the user on an associated user device (e.g., mobile device, television device, etc.). In another particular example, the atmosphere can be created by accessing a lighting system associated with the user or user device and causing particular light sources to switch on or off, select the level of light emitted from particular lighting devices, and/or select the color temperature of particular light sources, thereby modifying the lighting scheme in the user's surroundings. In yet another example, the atmosphere can be created by modifying an ambient noise emitted by a device connected to the user device (e.g., modifying the speed of a fan on a computing device associated with the user), emitting a particular scent from a device connected to the user device (e.g., causing a device that is capable of emitting particular scents and that is within a particular proximity of the user of the user device to emit a lavender scent), controlling an appliance or a home automation device connected to the user device (e.g., controlling the compressor of an HVAC unit or modifying the speed of the drum of a washer), etc.

In some implementations, the mechanisms can generate one or more profiles associated with a user device. For example, in some implementations, the mechanisms can generate various profiles that can be used to determine recommended actions suitable for the user of the user device. For example, the mechanisms can generate a profile that is indicative of the user's current mood, emotional state, and/or behavioral disposition and compare the generated profile with a target profile to determine a recommended action that, if performed, may move the user towards an objective or goal. In a more particular example, the target profile can be generated based on profiles or other actions of users that have indicated the achievement of a particular objective or goal (e.g., users that deem themselves to be highly successful, users that have lost five pounds in the past 30 days, etc.). In this example, the mechanisms can determine actions that are performed by users of user devices determined to have achieved a particular objective or goal and can determine whether one or more of these actions can be recommended to the user so that the user also achieves the particular objective or goal.

These and other features are further described in connection with FIGS. **1-14**.

Turning to FIG. **1**, FIG. **1** shows an example **100** of a generalized schematic diagram of a system on which the mechanisms for personalizing computerized services based on mood and/or behavior information from multiple data sources can be implemented in accordance with some implementations of the disclosed subject matter. As illustrated, system **100** can include one or more user devices **102**. User devices **102** can be local to each other or remote from each other. User devices **102** can be connected by one or more communications links **104** to a communication network **106** that can, in turn, be linked to a server **120** via a communications link **112**.

System **100** can include one or more data sources **110**. Data source **110** can be any suitable device that can gather and/or provide data relating to a user or a user device.

For example, data source **110** can include any suitable sensor that can gather and/or provide data relating to a user, such as an image sensor (e.g., a camera, a video recorder, etc.), an audio sensor (e.g., a microphone, a sound lever meter, etc.), a radio-frequency identification (RFID) sensor, a Global Positioning System (GPS), a sensor that is capable of measuring one or more biological parameters (e.g., a heart rate, a respiration rate, a blood pressure, a body temperature, skin moisture, etc.), a wearable pedometer, a Wi-Fi router, etc. In a more particular example, data source **110** can be multiple sensors connected to a home automation system registered to a user account associated with the user, where different data streams relating to the environment in the user's home can be received. In another more particular example, data source **110** can include multiple sensors connected to a coffee shop that is local to the user and an application program interface that allows the recommendation system to request data relating to the local coffee shop (e.g., how many patrons are currently in the shop based on a door sensor, how many patrons are currently waiting in line to order in the shop based on an image sensor, whether a group that the user is assigned is likely to visit the shop by comparing a target profile with a customer profile associated with the shop, etc.).

In another example, data source **110** can include a computing device, such as a desktop, a laptop, a mobile phone, a tablet computer, a wearable computing device, etc. Examples of data provided by such a computing device can include user generated data (e.g., text inputs, photos, touch inputs, etc.), user application generated data (e.g., data provided by a social networking application, a messaging application, a photo sharing application, a video sharing application, a media player application, etc.), data generated by one or more sensors resident on the computing device (e.g., an image sensor, a GPS, a sensor that is capable of measuring one or more biological parameters, etc.), data from a recording device (e.g., a microphone, a camera, a video camera, and/or any other suitable recording device) either associated with a user's computing device or as a standalone device in the user's environment, and/or any other suitable data relating to the user. For example, data source **110** can include a computing device that has been registered to a user having a user account and data can include data from various applications installed on the computing device and registered using the same user account. In this example, the user of the computing device can select which applications or which data types (e.g., location data, wireless network data, etc.) is used by an application executing on user device **102** or server **120**.

In yet another example, data source **110** can include one or more services that can provide data related to the user. Such services can include, for example, a social networking service, a messaging service, a video sharing service, a photo sharing service, a file hosting service, etc. In such an example, user device **102** or server **120** can communicate with data source **110** via one or more application programming interfaces and/or any other suitable data exchange mechanisms.

It should be noted that data from one or more data sources **110** can be used to determine the impact of a recommended action on a user's physical or emotional state. The emotional state of a user can be a complex phenomenon. Emotion can be a mental state that is associated with physiological activity and can be influenced by internal or external environmental conditions. Emotion can be associated with personality, mood, temperament, disposition, and motivation of a user. For example, emotional states can include happiness, contentment, tranquility, surprise, anger, fear, sadness, depression, disgust, tired, anxious, hurried, etc. In some examples, emotional states can be broadly classified into positive and negative emotions, where positive emotions can include happiness and contentment and negative emotions

can include anger and depression. In addition, an example of an internal environmental condition includes an old memory and an example of external stimulus includes stress or the relief of stress due to various environmental factors.

It should also be noted that the physical or emotional state of a user can be considered an overall snapshot or view of the user's physical characteristics or emotions at a point in time. Because multiple factors can be involved in a user's physical or emotional state, the physical or emotional state can fluctuate even over short periods of time. By using data relating to the user from multiple sources, a user's physical or emotional state can be predicted, which can be used to determine whether to recommend a particular action at a given time. Moreover, changes to a user's physical or emotional state can be predicted based on new or updated data relating to the user from multiple sources. Even further, changes to a user's physical or emotional state can be used to evaluate whether recommended actions to devices possessed by, or located proximate to, the user may be moving the user towards a goal or objective.

Data sources **110** can be local to each other or remote from each other. Each data source **110** can be connected by one or more communications links **108** to communication network **106** that can, in turn, be linked to server **120** via communications link **112** and/or user device **102** via communications link **104**.

It should be noted that, in some implementations, prior to accessing information from various data sources **110**, user device **102** can request (or require) that the user of user device **102** provide authorization to access each of the various data sources **110**. In some implementations, user device **102** can detect data sources **110** that are available to provide data relating to the user and can provide a user interface that allows the user of user device **102** to select which data sources **110** are to be used for obtaining data relating to the user.

FIG. **2** shows an illustrative example of types of input data that can be received by user device **102** and/or server **120**. As shown in FIG. **2**, server **120** can include a data storage engine **122** for requesting, consolidating, storing, and/or processing data relating to a user or a group of users and a data processing engine **124** for categorizing received data (e.g., contextual data, social data, general data, etc.), selecting particular portions of data that may be indicative of a physical or emotional state of the user, and processing the selected portions of data. For example, as also shown in FIG. **2**, server **120** can receive, among other things, various types of video data, text data, RFID data, ambient audio data (or keywords extracted from ambient audio data), and mobile device data.

Using one or more data sources **110**, data storage engine **122** can receive any suitable data. For example, from one or more data sources **110**, data storage engine **112** can receive and/or request data relating to activities engaged in by one or more users, such as "took a walk" and the distance traversed, visited a location that corresponds with a coffee shop, attended a social event (e.g., a conference, a party, a sporting event, etc.), attended a fitness training session, etc. As another example, from one or more data sources **110**, data storage engine **112** can receive and/or request data that includes timing information related to an activity, such as a duration of the activity, a time corresponding to the activity, etc. As yet another example, data storage engine **112** can receive and/or request data that includes a number of occurrences of an activity engaged in by one or more users during a given time period (e.g., a day of the week, a couple of days, weekdays, weekends, etc.), a number of users that engage in a given activity, and/or any other suitable information relating to frequency information related to a given activity. As still another example, in some implementations, data storage engine **122** can receive information indicating a behavioral and/or emotional state of an animate object, such as a pet, associated with the user. As a specific example, the received information can indicate that the user's pet is excited, anxious, sad, sleeping, and/or any other behavioral and/or emotional state, which can be determined using any suitable techniques, for example, those described below in connection with FIG. **12**.

Using one or more data sources **110** that include social data sources, data storage engine **122** can receive and/or request data relating to content and/or information published by the user on a social networking service. For example, the data can include one or more mood states published by a user on a service (e.g., a social networking service, a messaging service, a video sharing service, a photo sharing service, an electronic commerce service, etc.). As another example, the data can include comments, messages, posts, locations, and/or any other suitable content published by the user on a social networking service. As still another example, the data can include any suitable information relating to one or more social connections of the user on a social networking service, content posted by the social connections, locations associated with the social connections, etc.

Using one or more data sources **110**, data storage engine **112** can receive and/or request data relating to user interactions with one or more media content items. For example, the data can include any suitable information relating to a media content item with which the user has interacted. In a more particular example, the data can include a type of the media content item, a description of the media content item, a link to the media content item (e.g., a URL), an identifier that can identify the media content item (e.g., a URI, a program identifier, etc.), an author of the media content item, an artist related to the media content item, etc. As another example, the data can include any suitable information about a type of a user interaction with a media content item, such as consuming the media content item, publishing the media content item via a social networking service or any other suitable service, sharing the media content item with other users, liking the media content item via a social networking service or any other suitable service, commenting on the media content item, etc. As yet another example, the data can include any suitable timing information related to a user interaction with a media content item, such as a duration of the user interaction, a time corresponding to the user interaction, etc.

Using one or more data sources **110**, data storage engine **112** can receive and/or request biometric data associated with the user. For example, in response to receiving authorization to access biometric data from data source **110** that includes a sensor, the biometric data can include any suitable physiological parameter associated with the user, such as a heart rate, a respiration rate, a blood pressure, a body temperature, skin moisture, etc. As another example, the biometric data can include a range of physiological parameters, such as a heart rate range, a blood pressure range, etc.

Using one or more data sources **110**, data storage engine **112** can receive and/or request location data associated with the user. For example, in response to receiving authorization to access location information, the location data can include any suitable information that can be used to estimate a location of a computing device associated with the user, such as an identifier associated with the computing device (e.g.,

an IP address, GPS signals generated by the computing device, Wi-Fi access points associated with the computing device, information about a cell tower to which the computing device is connected, etc. As another example, the location data can include any suitable information that can be used to estimate a location of the user, such as a location published by the user using a suitable service (e.g., a social networking service), a location that a user intends to visit (e.g., a location associated with a social event scheduled using a calendar application executing on a mobile device, a social network account associated with the user, etc.), etc.

In some implementations, data storage engine **112** can categorize and/or classify data received from data sources **110**.

For example, data storage engine **122** can receive data from multiple data sources **110** (e.g., using one or more application programming interfaces) and data processing engine **124** can classify the received data as general data when the received data includes information about one or more services used by a user (e.g., a social networking service, an email service, a messaging service, a video sharing service, etc.), search history associated with a user (e.g., keywords inputted by the user), etc.

As another example, data storage engine **122** can receive data from multiple data sources **110** (e.g., using one or more application programming interfaces) and data processing engine **124** can classify the received data as contextual data when the received data includes information about a location of user device **102**, traffic information, weather information based on location information from user device **102** (e.g., "sunny," "cold," etc.), population density information within a given location, a location context relating to data provided by a data source **110** (e.g., "work," "home," "vacation," etc.), and/or any other suitable information that can provide contextual information related to the user.

As yet another example, data storage engine **122** can receive data from multiple data sources **110** (e.g., using one or more application programming interfaces) and data processing engine **124** can classify the received data as social data when the received data stream includes information related to social events involving multiple users (e.g., a conference scheduled using a social networking service, a calendar application, etc.), content and/or information published by one or more users using a service (e.g., a social networking service, a video sharing service, a photo sharing service, etc.), information about one or more social connections of a user, and/or any other suitable information that can be classified as social data. In a more particular example, social data associated with a user account of a social service can be retrieved in response to determining that the user account is also authenticated on user device **102**.

As still another example, data storage engine **122** can receive data from multiple data sources **110** (e.g., using one or more application programming interfaces) and data processing engine **124** can classify the received data as personal data when the received data stream includes information about user goals, personal interests of a user (e.g., a user's stated interest available on a social networking service, media content consumed and/or liked by a user, etc.), one or more utterances generated by a user, and/or any other suitable information that can be regarded as personal. In this example, data processing engine **124** can discard personal data unless specific authorization to use such personal data is received from the user of user device **102**.

In some implementations, data processing engine **124** can process data streams that are provided by data source **110** and/or that are stored and/or processed by data storage engine **122**.

In some implementations, data processing engine **124** can determine whether data or a particular portion of data from data source **110** is relevant to a goal or objective of the user. It should be noted that, in some implementations, data processing engine **124** can determine whether data or a particular portion of data from multiple data sources **110** is relevant to a goal or objective of users assigned to a particular group of users.

In some implementations, data processing engine **124** can determine whether data or a particular portion of data from data source **110** is indicative of the emotional state of the user. These determinations can be made in any suitable manner. For example, the determination can be made using a suitable classifier that can classify input data or a portion of input data as being relevant to a goal or as being irrelevant to the goal.

In a more particular example, data processing engine **124** can select one or more portions of data, where each portion of data can correspond to any suitable period of time, such as a few minutes, a couple of hours, a day of the week, a couple of days, a week, a month, etc. In some implementations, the portions of data can be identified in any suitable manner. For example, a determination can be made using a classifier that can classify a portion of data as being relevant to a goal. In another example, a determination can be made using a classifier that can classify a portion of data as likely to be indicative of a user's emotional state. In yet another example, a determination can be made using a classifier that can classify a portion of data as being relevant to a recommended action (e.g., data that can be used to determine the likelihood that the action may impact the user's emotional state, data that can be used to determine when the recommended action is to be executed, etc.). It should be noted that the classifier can be trained using any suitable machine learning algorithm, such as a support vector machine, a decision tree, a Bayesian model, etc.

In some implementations, upon selecting various portions of data from multiple data sources **110**, data processing engine **124** can assign a weight to each of the portions of data. For example, for a particular goal or objective, data processing engine **124** can determine that social data from particular data sources **110** is to be weighted such that it has more influence on the determination of the recommended action or output. This may be because social data that relates to the user and that is indicative of the user's emotional state is considered highly relevant to the objective of making new friends. In another example, this may be because social data tends to provide an accurate indication of the user's emotional state (e.g., as the user of the user devices frequently posts status updates on multiple social networking websites) and because, prior to recommending a particular action, such as driving a vehicle to a particular location, data processing engine **124** may take into account such social data. In another suitable example, weights can be set by the user of user device **102** such that the user can tune the application and how particular types of data relating to the user are processed. In a more particular example, the user can set weights associated with social data such that the effect of social data in the determination of an action or output is reduced.

In some implementations, data processing engine **124** can generate one or more profiles relating to the user. For example, data processing engine **124** can use the received

data to generate a baseline profile that is used to assign the user of user device **102** to a group (e.g., a group of similar users for the particular objective or goal). In this example, data processing engine **124** can also generate a target profile for the individual user and/or the group of users, which can include data corresponding to similar users that have indicated an achievement of the particular objective or goal. Alternatively, data processing engine **124** can generate a target profile that includes data corresponding to similar users that have indicated a failure to attain the particular objective or goal. As another example, data processing engine **124** can use the received data and, in some implementations, request and receive updated data to generate a current profile associated with the user that is indicative of the user's current physical or emotional state.

Any suitable profile relating to the user of user device **102** or a group of users can be generated using any suitable approach. For example, data processing engine **124** can generate one or more profiles that are indicative of the user's physical or emotional state over a given time period. For example, a baseline profile associated with a user can be generated based on data that is determined to be indicative of the user's physical or emotional state during a given time period, such as mornings, a given day, weekdays, weekends, a given week, a season, and/or any other suitable time period. In another example, data processing engine **124** can generate one or more profiles that are indicative of the user's physical or emotional state for a given context, such as a typical work day, a vacation day, mood and/or behavior when user device **102** is located in the proximity of the user's home, mood and/or behavior when user device **102** indicates that the temperature in the proximity of user device **102** is below 65 degrees, etc.

In some implementations, server **120** can include an output recommendation engine **126** for determining and/or providing a recommended action that may affect or impact the physical or emotional state of the user. For example, in response to comparing a current profile corresponding to the user with a target profile, output recommendation engine **126** can determine a recommended action for the user. In a more particular example, output recommendation engine **126** can, based on comparing the current profile indicating that the user has a particular objective and a target profile of similar users that includes information relating to users where it has been determined that they have achieved the particular objective and information relating to users where it has been determined that they have not achieved the particular objective, determine one or more recommended actions that can impact the physical or emotional state of the user and, upon performing the recommended action, may assist the user in reaching the particular objective.

It should be noted that, in some implementations, output recommendation engine **126** can cause any suitable recommended action to be executed on user device **102** or any other suitable computing device associated with the user. As shown in FIG. **2**, the action or output can include, among other things, a haptic or touch sensitive feedback, a sensory feedback (e.g., image content, light cues, music, video messages, video content, etc.), an ambient-related feedback (e.g., causing a scent to be emitted from a suitable device, modifying a lighting scheme by a lighting or home automation system, etc.), and/or a content-related action (e.g., presenting text, image content, video content, audio content).

For example, output recommendation engine **126** can determine that a message is to be presented to user device **102** associated with the user to prompt the user to engage in an activity. This may, for example, assist the user in reaching a particular objective or goal. In a more particular example, output recommendation engine **126** can determine that the message is to be presented in a particular form (e.g., by email, text message, mobile notification, account notification, a user interface, and/or in any other suitable manner) and/or at a particular time (e.g., based on the current physical or emotional state of the user).

As another example, output recommendation engine **126** can determine that an atmosphere is to be created in the proximity of the user. This may, for example, assist the user in reaching a particular objective or goal and/or affect the determined emotional state of the user. In a more particular example, based on a determination of the user's current physical or emotional state, output recommendation engine **126** can cause music content, a feed of news articles that have been designated as being positive content, and/or a feed of image content that have been designed as being amusing content to be presented on user device **102** associated with the user. In another more particular example, output recommendation engine **126** can cause a sound effect (e.g., rain sounds) to be presented on a device having an audio output device that is connected to the user device, can cause ambient light in the user's surroundings to be adjusted using a lighting system connected to the user device, and/or can cause a scent to be emitted by actuating a scent generator in a proximity of the user using user device **102**.

Referring to FIG. **1**, any suitable user device **102** can be used to execute a recommended action from output recommendation engine **126**. For example, user device **102** can be a wearable computing device, a television, a monitor, a liquid crystal display, a three-dimensional display, a touchscreen, a simulated touch screen, a gaming system, a portable DVD player, a portable gaming device, a mobile phone, a personal digital assistant (PDA), a music player, a tablet, a laptop computer, a desktop computer, a mobile phone, a media player, a lighting device, a scent generator, and/or any other suitable device that can be used to perform one or more recommended actions. It should be noted that, in some implementations, user device **102** can have an application programming interface such that the recommended output determined by output recommendation engine **126** can be transmitted to a suitable system, such as a home automation system, where the system uses the application programming interface to cause the recommended output to be executed on one or more user devices **102**.

In a more particular example, server **120** can determine that a user associated with a user device has a particular objective or goal (e.g., getting more exercise during the course of the user's workday). In response to receiving authorization from the user of user device **102** to access social networking data, location data, and calendar data from various devices and other data sources, server **120** can determine that the user of the user device is currently feeling relatively low energy based on the social data and that the user has a meeting that is scheduled at a particular time and that is taking place at a particular location from the calendar data (with no obligations between the current time and the time of the meeting). Server **120** can use such data and take into account historical data. For example, based on biometric data from a wearable pedometer associated with the user, server **120** can determine the amount of activity that the user of user device **102** has engaged in that month to date or week to date and determine whether the user is likely to meet an indicated objective or goal or likely to meet an average activity level. In another example, based on location infor-

mation, server **120** can determine the frequency that the user uses a car service to attend meetings at a particular location that is ten blocks away from a work location associated with the user. In yet another example, based on stated interests and/or affinities on a social networking service, server **120** can determine that the user of user device **102** likes flowers. In a further example, using mapping data that determines a route between the work location associated with the user and the location of the meeting. Taking into account these portions of data from multiple devices and/or data sources, server **120** can cause one or more recommended actions to be executed on one or more devices, such as a notification to a user device that prompts the user to purchase a cup of coffee from a nearby coffee shop in five minutes, a notification to a user device that prompts the user to walk to the meeting using a particular route that includes an option to visit an orchid shop that recently opened in a location that is along the provided route. Alternatively, server **120** can, at a particular time prior to the meeting, cause a scent generator located in proximity of user device **102** to emit a lavender scent. In another alternative example, server **120** can, at a particular time prior to the meeting, determine the weather in proximity of user device **102** prior to causing a notification that prompts the user to walk to the meeting using a particular walk (e.g., upon determining that the chance of precipitation is greater than a particular threshold value, upon determining that it is "too hot" for the user based on the determined temperature and user data as to what is considered "too hot," etc.).

Continuing with this example, server **120** can determine that the user of the user device has visited the orchid shop and/or that the user is walking to the coffee shop as recommended by the recommended action and server **120** can use an application programming interface of the coffee shop to request the number of consumers in the coffee shop and can determine that the user may have a particular waiting time at the coffee shop. Server **120** can then determine, using its respective application programming interface, that another coffee shop within the same franchise has a lesser waiting time and is close to the user of user device **102** (e.g., a block away from the current location provided by user device **102**). Server **120** can transmit an updated or revised recommended action to user device **102**.

In some implementations, it should be noted that server **120** can identify one or more user devices **102** or other suitable devices for executing a recommended action that are in a particular proximity of the user (e.g., a television, an audio system, a media player, a scent generator, a lighting system, etc.). For example, server **120** can cause user device **102** to detect devices that are connected to user device **102** and detect devices that are in proximity of user device **102** (e.g., using device discovery functions). In response, server **120** can cause a song that is deemed to be a relaxing song to be streamed from a service (e.g., a media streaming service) and output using a device (e.g., a mobile phone, a media player, etc.) associated with the user. In addition, server **120** can cause a lavender scent to be emitted using a scent generator at a particular time in response determining that the user likes lavenders (e.g., based on information published on the user's social network page) and based on the current emotional state of the user.

In some implementations, server **120** can personalize services for multiple users that each have a corresponding user device based on the combined physical or emotional state of the users. For example, the users can be a group of users having user devices that are in the same location (e.g., a coffee shop, a conference room, proximity of a given user, a town, an office, etc. based on location information or an online calendar), a group of users having user devices that are connected to each other on a social networking service, a group of users having user devices that are determined to be similar users, and/or any other suitable users.

Referring back to FIG. **1**, system **100** can include one or more servers **120**. Server **120** can be any suitable server or servers for providing access to the mechanisms described herein for personalizing services based on mood and/or behavior information from multiple data sources, such as a processor, a computer, a data processing device, or any suitable combination of such devices. For example, the mechanisms for personalizing services based on mood and/or behavior information from multiple data sources can be distributed into multiple backend components and multiple frontend components and/or user interfaces. In a more particular example, backend components (such as mechanisms for identifying an objective for a user, selecting particular portions of data from one or more data streams, generating profile information, determining recommended actions for one or more devices associated with the user, etc.) can be performed on one or more servers **120**. In another more particular example, frontend components (such as presentation of a recommended action in the form of content, executing a recommended action, detecting that a user device is near other devices, etc.) can be performed on one or more user devices **102** and/or display devices **110**.

In some implementations, each of user devices **102**, data sources **110** and server **120** can be any of a general purpose device, such as a computer, or a special purpose device, such as a client, a server, etc. Any of these general or special purpose devices can include any suitable components such as a hardware processor (which can be a microprocessor, a digital signal processor, a controller, etc.), memory, communication interfaces, display controllers, input devices, etc. For example, user device **102** can be implemented as a smartphone, a tablet computer, a wearable computer, a vehicle computing and/or entertainment system (e.g., as used in a car, a boat, an airplane, or any other suitable vehicle), a laptop computer, a portable game console, a television, a set-top box, a digital media receiver, a game console, a thermostat, a home automation system, an appliance, any other suitable computing device, or any suitable combination thereof.

Communications network **106** can be any suitable computer network or combination of such networks including the Internet, an intranet, a wide-area network (WAN), a local-area network (LAN), a wireless network, a Wi-Fi network, a digital subscriber line (DSL) network, a frame relay network, an asynchronous transfer mode (ATM) network, a virtual private network (VPN), a peer-to-peer connection, etc. Each of communications links **104**, **108**, and **112** can be any communications links suitable for communicating data among user devices **102**, data sources **110**, and server **120**, such as network links, dial-up links, wireless links, hard-wired links, any other suitable communications links, or any suitable combination of such links. Note that, in some implementations, multiple servers **120** can be used to provide access to different mechanisms associated with the mechanisms described herein for personalizing services based on mood and/or behavior information from multiple data sources. For example, system **100** can include: a data selection server **120** that facilitates the selection of data from multiple data sources that is indicative of an emotional state of the user; a profile server **120** that generates a baseline profile to assign the user into a group of users, determines a target profile based on the assigned group of user and based

on the objectives or goals of the user, generates a current profile representing the user, and compares the current profile with the target profile; a recommendation server **120** that determines one or more recommended actions that may have a likelihood of impacting the emotional state of the user and/or may move the user towards an objective or goal; a delivery server **120** that causes the recommended action to be executed (e.g., transmit content to a particular device, transmit instructions to a home automation system, etc.); and/or any other suitable servers for performing any suitable functions of the mechanisms described herein.

FIG. **3** shows an example **300** of hardware that can be used to implement one or more of user devices **102** and servers **120** depicted in FIG. **1** in accordance with some implementations of the disclosed subject matter. Referring to FIG. **3**, user device **102** can include a hardware processor **302**, a display/input device **304**, memory **306**, and a transmitter/receiver **308**, which can be interconnected. In some implementations, memory **306** can include a storage device (such as a computer-readable medium) for storing a user device program for controlling hardware processor **302**.

Hardware processor **302** can use the user device program to execute and/or interact with the mechanisms described herein for personalizing services based on mood and/or behavior using multiple data sources, which can include presenting one or more recommendation interfaces (e.g., for inputting objective or goal information, for providing authorization to access data from one or more data sources, for selecting data sources, etc.), and can include executing a recommended action. In some implementations, hardware processor **302** can transmit and receive data through communications link **104** or any other communication links using, for example, a transmitter, a receiver, a transmitter/receiver, a transceiver, and/or any other suitable communication device, such as transmitter/receiver **308**. Display/input device **304** can include a touchscreen, a flat panel display, a cathode ray tube display, a projector, a speaker or speakers, and/or any other suitable display and/or presentation devices, and/or can include a computer keyboard, a computer mouse, one or more physical buttons, a microphone, a touchpad, a voice recognition circuit, a touch interface of a touchscreen, a camera, a motion sensor such as an optical motion sensor and/or an accelerometer, a temperature sensor, a near field communication sensor, a biometric data sensor, and/or any other suitable input device. Transmitter/receiver **308** can include any suitable transmitter and/or receiver for transmitting and/or receiving, among other things, instructions for presenting content, information related to a current control level, requests for location information, etc., and can include any suitable hardware, firmware and/or software for interfacing with one or more communication networks, such as network **106** shown in FIG. **1**. For example, transmitter/receiver **308** can include: network interface card circuitry, wireless communication circuitry, and/or any other suitable type of communication network circuitry; one or more antennas; and/or any other suitable hardware, firmware and/or software for transmitting and/or receiving signals.

Server **120** can include a hardware processor **312**, a display/input device **314**, memory **316** and a transmitter/receiver **318**, which can be interconnected. In some implementations, memory **316** can include a storage device (such as a computer-readable medium) for storing a recommendation program for controlling hardware processor **312**.

Hardware processor **312** can use the recommendation program to execute and/or interact with the mechanisms described herein for: obtaining information associated with an objective of a user of a computing device from a plurality of data sources; identifying an objective for a user of a user device; receiving information associated with the user from multiple data sources; determining that a portion of information from each of the multiple data sources is relevant to the user having the identified objective; assigning the user into a group of users from a plurality of groups based on the identified objective and the portion of information from each of the multiple data sources; determining a target profile associated with the user based on the identified objective and the assigned group; generating a current profile for the user based on the portion of information from each of the multiple data sources; comparing the current profile with the target profile to determine a recommended action, where the recommended action is determined to have a likelihood of impacting the emotional state of the user; causing the recommended action to be executed (e.g., on a device possessed by, or located proximate to, the user); determining one or more devices connected to the computing device, wherein each of the one or more devices has one or more device capabilities; and/or transmitting and receiving data through communications link **108**. In some implementations, the recommendation program can cause hardware processor **312** to, for example, execute at least a portion of process **400** as described below in connection with FIG. **4**. In some implementations, hardware processor **312** can transmit and receive data through communications link **114** or any other communication links using, for example, a transmitter, a receiver, a transmitter/receiver, a transceiver, and/or any other suitable communication device such as transmitter/receiver **318**. Display/input device **314** can include a touchscreen, a flat panel display, a cathode ray tube display, a projector, a speaker or speakers, and/or any other suitable display and/or presentation devices, and/or can include a computer keyboard, a computer mouse, one or more physical buttons, a microphone, a touchpad, a voice recognition circuit, a touch interface of a touchscreen, a camera, a motion sensor such as an optical motion sensor and/or an accelerometer, a temperature sensor, a near field communication sensor, a biometric data sensor, and/or any other suitable input device. Transmitter/receiver **318** can include any suitable transmitter and/or receiver for transmitting and/or receiving, among other things, content to be presented, requests for status information of display device **110**, requests for content, requests for location information, etc., and can include any suitable hardware, firmware and/or software for interfacing with one or more communication networks, such as network **106** shown in FIG. **1**. For example, transmitter/receiver **318** can include: network interface card circuitry, wireless communication circuitry, and/or any other suitable type of communication network circuitry; one or more antennas; and/or any other suitable hardware, firmware and/or software for transmitting and/or receiving signals.

In some implementations, server **120** can be implemented in one server or can be distributed as any suitable number of servers. For example, multiple servers **120** can be implemented in various locations to increase reliability and/or increase the speed at which the server can communicate with user devices **102** and/or data sources **110**. Additionally or alternatively, as described above in connection with FIG. **1**, multiple servers **120** can be implemented to perform different tasks associated with the mechanisms described herein.

Turning to FIG. **4**, an illustrative example **400** of a process for personalizing computerized services based on the physical or emotional state of a user of a user device using data

from multiple data sources in accordance with some implementations of the disclosed subject matter is shown.

It should be noted that process **400** can personalize computerized services, where data from multiple data sources can be used to determine the impact of a computerized service on a physical or emotional state of a user having a user device. The emotional state of a user can be a complex phenomenon. Emotion can be a mental state that is associated with physiological activity and can be influenced by internal or external environmental conditions. Emotion can be associated with personality, mood, temperament, disposition, and motivation of a user. For example, emotional states can include happiness, contentment, tranquility, surprise, anger, fear, sadness, depression, disgust, tired, anxious, hurried, etc. In some examples, emotional states can be broadly classified into positive and negative emotions, where positive emotions can include happiness and contentment and negative emotions can include anger and depression. In addition, an example of an internal environmental condition includes an old memory and an example of external stimulus includes stress or the relief of stress due to various environmental factors.

It should also be noted that the physical or emotional state of a user can be considered an overall snapshot or view of the user's physical characteristics or emotions at a point in time. Because multiple factors can be involved in a user's physical or emotional state, the physical or emotional state can fluctuate even over short periods of time. By using data relating to the user from multiple sources, a user's physical or emotional state can be predicted, which can be used to determine whether to recommend a particular computerized action at a given time. Moreover, changes to a user's physical or emotional state can be predicted based on new or updated data relating to the user from multiple sources. Even further, changes to a user's physical or emotional state can be used to evaluate whether recommended computerized actions to devices possessed by, or located proximate to, the user may be moving the user towards a particular goal or objective.

As illustrated, process **400** can begin by receiving user input relating to a particular objective or goal at **410**. Illustrative examples of a particular objective or goal can be getting more exercise (e.g., generally increasing the current activity level, getting any form of exercise for at least one hour per day, etc.), losing weight (e.g., generally losing weight, losing ten pounds in three months, etc.), making more friends, accomplishing a particular emotional state (e.g., feel more productive, feel less stressed, etc.), etc.

In a more particular example, in response to receiving authorization from a user of a user device to access social data relating to the user from a social networking service, process **400** can extract keywords from social media posts published by the user on the social networking service to determine one or more objectives of the user. In this example, social data relating to the user from a social networking service can be received, which can include messages or posts having text, image content, video content, and/or audio content, messages posted by other users that are connected to the user, and contextual information, such as timing information, location information, and a declared mood or emotional state of the user or users connected to the user.

In another more particular example, in response to installing a recommendation application on a computing device associated with the user, the recommendation application can present a recommendation interface on the computing device that prompts the user to select an objective from the user interface. For example, the recommendation interface can be presented as a recommendation card, a notification, or any other suitable user interface that prompts the user to indicate an objective or goal. An illustrative example of a recommendation interface that can be presented on a computing device is shown in FIG. **5**. As shown, in some implementations, a user device **102**, such as a mobile device **500**, can prompt the user to input an objective in recommendation interface **510**, such as "get more exercise" or "improve your mood." The suggested objectives in recommendation interface **510** can be presented based on any suitable criterion (e.g., default objectives, popular objectives, objectives selected based on recent searches inputted into the user device, objectives selected based on location information associated with the user device, objectives based on attributes inferred from data sources authorized by the user of the user device, etc.). As also shown, a reason for the suggested objective can be provided, such as "Based on your recent searches" and "Based on your recent posts." Additionally or alternatively, the recommendation interface can present the user of mobile device **500** with a search field to provide keywords relating to an objective or goal that the user desires to achieve.

Referring back to FIG. **4**, at **420**, the recommendation system can determine one or more goals for a user of a user device based on the determined objective. For example, in response to determining that the objective is to lose weight, the recommendation system can determine goals that are associated with the objective of losing weight—e.g., achieving a first activity level for the first week and a second activity level for the second week, achieving an average activity level over the first month, waking up at a particular time every morning, achieving a threshold amount of rest at the end of each day, eating at particular times on weekdays, etc. As described hereinbelow, the recommendation system can generate various profiles, such as profiles of similar users that each have user devices, profiles of users having user devices who have indicated that they have achieved the determined objective or one of the goals, profiles of users having user devices who have indicated that they have failed to achieve the determined objective or one of the goals, etc. In this example, the recommendation system can process these profiles to determine goals associated with an objective (e.g., which goals were achieved by users that are deemed to be similar to the user, which goals were achieved within a particular amount of time, etc.). In a more particular example, in response to selecting one of the objectives presented in recommendation interface **510**, the recommendation system can determine multiple goals associated with the selected objective and select a portion of those goals based on profile information.

In some implementations, the recommendation system can receive any suitable data associated with the user from multiple data sources at **430**. For example, from one or more data sources, the recommendation system can receive and/or request data relating to activities engaged in by one or more users of user devices, such as took a walk and the distance traversed using a mobile device with location services, visited a location that corresponds with a coffee shop using a mobile device with social services, attended a social event (e.g., a conference, a party, a sporting event, etc.) using a mobile device with an online calendar, attended a fitness training session using a mobile device with an online calendar and/or social services, etc. As another example, from one or more data sources, the recommendation system can receive and/or request data that includes timing information related to an activity, such as a duration of the

activity, a time corresponding to the activity, etc. As yet another example, the recommendation system can receive and/or request data that includes a number of occurrences of an activity engaged in by one or more users during a given time period (e.g., a day of the week, a couple of days, weekdays, weekends, etc.), a number of users that engage in a given activity, and/or any other suitable information relating to frequency information related to a given activity.

In some implementations, the recommendation system can receive and/or request data relating to content and/or information published by the user on a social networking service. For example, the data can include one or more mood states published by a user on a service (e.g., a social networking service, a messaging service, a video sharing service, a photo sharing service, an electronic commerce service, etc.). As another example, the data can include comments, messages, posts, locations, and/or any other suitable content published by the user on a social networking service. As still another example, the data can include any suitable information relating to one or more social connections of the user on a social networking service, content posted by the social connections, locations associated with the social connections, etc.

In some implementations, the recommendation system can receive and/or request data relating to user interactions with one or more media content items. For example, the data can include any suitable information relating to a media content item with which the user has interacted. In a more particular example, the data can include a type of the media content item, a description of the media content item, a link to the media content item (e.g., a URL), an identifier that can identify the media content item (e.g., a URI, a program identifier, etc.), an author of the media content item, an artist related to the media content item, etc. As another example, the data can include any suitable information about a type of a user interaction with a media content item on a user device, such as consuming the media content item, publishing the media content item via a social networking service or any other suitable service, sharing the media content item with other users, liking the media content item via a social networking service or any other suitable service, commenting on the media content item, etc. As yet another example, the data can include any suitable timing information related to a user interaction with a media content item on a user device, such as a duration of the user interaction, a time corresponding to the user interaction, etc.

In some implementations, the recommendation system can receive and/or request biometric data associated with the user of a user device. For example, in response to receiving authorization to access biometric data from a data source that includes a sensor, the biometric data can include any suitable physiological parameter associated with the user, such as a heart rate, a respiration rate, a blood pressure, a body temperature, skin moisture, etc. As another example, the biometric data can include a range of physiological parameters, such as a heart rate range, a blood pressure range, etc.

In some implementations, the recommendation system can receive and/or request location data associated with the user of a user device. For example, in response to receiving authorization to access location information, the location data can include any suitable information that can be used to estimate a location of a computing device associated with the user, such as an identifier associated with the computing device (e.g., an IP address, a device identifier, a media address control (MAC) address, a serial number, a product identifier, etc.), GPS signals generated by the computing device, Wi-Fi access points associated with the computing device, information about a cell tower to which the computing device is connected, etc. As another example, the location data can include any suitable information that can be used to estimate a location of the user, such as a location published by the user using a suitable service (e.g., a social networking service), a location that a user intends to visit (e.g., a location associated with a social event scheduled using a calendar application executing on a mobile device, a social network account associated with the user, etc.), etc.

In some implementations, the recommendation system can present a recommendation interface, such as the recommendation interface shown in FIG. **6**, where the user of mobile device **500** is prompted with data sources for selection. For example, various data sources can be detected by the recommendation system executing on mobile device **500** and, in response to detecting the various data sources, the user can be prompted to select which data sources to obtain data associated with the user. As shown in FIG. **6**, a recommendation interface prompts the user of mobile device **500** to select from various data sources that are available to the recommendation application, where the user has indicated a permission to access location data from mobile device **500** and social data from services that have been authenticated using mobile device **500**. In a more particular example, the recommendation system can prompt the user to provide authorization to access particular data sources and select which data sources may include data that is relevant towards accomplishing a goal or objective. In this example, the recommendation system can provide an interface prompting the user of the user of the user device to provide credentials, such as a username and password, for accessing a particular data source.

In some implementations, the recommendation system can prompt the user to provide additional information in response to selecting one or more data sources for obtaining user, such as using recommendation interface **610**. For example, the recommendation system can determine that, in order to generate a baseline profile for the user, certain portions of the baseline profile can be derived or satisfied using data obtained from the selected data sources and other portions of the baseline profile remain incomplete. In response, the recommendation system can generate an interface that prompts the user to provide such information—e.g., if the goal is "losing weight," such an interface can prompt the user of mobile device **500** to input a height value and a weight value.

Referring back to FIG. **4**, the recommendation system can select portions of the data received from multiple data sources based on the objectives or determined goals at **440**. For example, the recommendation system can receive data from multiple data sources (e.g., using one or more application programming interfaces) and can determine that the received data is to be classified into various categories of data. These categories can include, for example, general data, contextual data, social data, and personal data. Examples of general data can include information about one or more services used by a user (e.g., a social networking service, an email service, a messaging service, a video sharing service, etc.), search history associated with a user (e.g., keywords inputted by the user), etc. Examples of contextual data can include information about a location of user device **102**, traffic information, weather information based on location information from user device **102** (e.g., "sunny," "cold," etc.), population density information within a given location, a location context relating to data provided by a data source **110** (e.g., "work," "home," "vacation,"

etc.), information relating to devices located near or connected to a user device, and/or any other suitable information that can provide contextual information related to the user. Examples of social data can include information related to social events involving multiple users (e.g., a conference scheduled using a social networking service, a calendar application, etc.), content and/or information published by one or more users using a service (e.g., a social networking service, a video sharing service, a photo sharing service, etc.), information about one or more social connections of a user, and/or any other suitable information that can be classified as social data. Examples of personal data can include personal interests of a user (e.g., a user's stated interest available on a social networking service, media content consumed and/or liked by a user, etc.), one or more utterances generated by a user, and/or any other suitable information that can be regarded as personal.

In some implementations, the recommendation system can create a data stream for each category of data. For example, in response to categorizing particular data from multiple services as being social data, the recommendation system can aggregate the social data as it is being received and create a social data stream that includes timestamped social data from the multiple sources. Alternatively, upon receiving authorization from the user to access a particular data source, the recommendation system can categorize the data received from that source and place the data into a data stream that is associated with that data source, such as a social data stream of timestamped social data from a particular social source. For example, as shown in FIG. **7**, multiple data streams from multiple data sources can be obtained—e.g., general data (G**5** and G**13**), personal data (P**1** and P**42**), social data (S**9** and S**25**), and contextual data (C**33** and C**57**).

In some implementations, the recommendation system can select particular portions of data by determining which categories of data to analyze and which portions of the data are to be used to determine a recommendation action that may, for example, affect the physical or emotional state of the user. In response to determining an objective at **410** or a goal at **420** for the user of the user device, the recommendation system can select particular categories of data that may include data that is relevant to the objective or goal. For example, the recommendation system can determine that social data and contextual data are likely to be relevant to the objective of losing weight. In response to analyzing the data relating to the user from multiple data sources at **430**, the recommendation system can select particular categories of data from particular data sources and select particular time portions of data that are indicative or representative of the physical or emotional state of the user. For example, the recommendation system can, in response to receiving authorization from a user of a user device to receive data relating to the user from multiple data sources, determine that, during weekdays between 9 AM and 5 PM, the user device is not typically used on social data sources and that contextual data from the user device and devices connected to the user device are likely to be representative of the emotional state of the user. It should be noted that, using the received data and/or the determined objectives and goals, the recommendation system can select different subsets of data for making different determinations—e.g., a subset of data for recommending a particular action, a subset of data that is indicative of the emotional state of the user during a particular time of the day, a subset of data that is indicative of the emotional state of the user during an average day, a subset of data that is representative of the activities of the user on a given day, etc.

In some implementations, each objective or goal can have an associated data template for retrieving data that is related to the user and that is relevant to the objective or goal. For example, in response to determining an objective at **410** or a goal at **420**, the recommendation system can retrieve an associated data template that includes particular data fields, such as particular social-related data fields (e.g., keywords extracted from social posts and an associated time), contextual-related data fields (e.g., location information from multiple devices associated with the user corresponding to the times of each social post), and general data fields (e.g., type of applications that the user device has installed and device profiles of devices that are nearby the user device). As described above, in response to determining that information for particular data fields may not be completed or derived using data from the data sources, the recommendation system can prompt the user to input such missing data (e.g., by generating a user interface prompt the user to input data and/or input the accuracy of inferences made about the user).

It should be noted that, although the recommendation system can make a determination based on particular subsets of data and can retrieve data templates that request particular portions of data, the user of a user device, such as user device **102**, can be provided with controls for setting which data sources are used (e.g., a specific social networking service, a specific mobile device, etc.) and which types of data are used by the recommendation system (e.g., social information from a specific social networking service and not data determined to include personal information, social post information from a social networking service and not relationship information from a social messaging service, etc.). For example, the user can be provided with an opportunity to select a particular type of data from a particular data source that may include data relevant to the user for a particular goal or objective.

In some implementations, using the selected portions of data from the multiple data sources, the recommendation system can determine a baseline profile for the user at **450**. For example, the recommendation system can process the selected portions of data and generate one or more baseline profiles associated with each objective or goal. In a more particular example, a baseline user profile associated with a goal can include any suitable information relating to the physical or emotional state of the user (e.g., "happy," "unhappy," etc.) and information about one or more user behaviors or habits (e.g., commuting, lunch break, weekly meetings, exercise groups, etc.). In another more particular example, a baseline user profile can use heart rate information, temperature information, galvanic skin response information, location information, and social post information, match such information with an emotional state, and establish baseline patterns for emotional state through a given time period, a day, a week, a season, etc.

In some implementations, using the selected portions of data from the multiple data sources, the recommendation system can determine an overall baseline profile for the user that includes multiple sub-profiles—e.g., a sub-profile that uses the data to predict the current emotional state of the user, a sub-profile that describes the typical activity level of the user, a sub-profile that describes typical behaviors of the user at particular times of the day, etc. Any suitable number of sub-profiles can be generated to create an overall baseline profile of the user. It should also be noted that, in some implementations, the recommendation system can use dif-

ferent subsets of data for each of the sub-profiles that form the overall baseline profile of the user.

In some implementations, the recommendation system can assign the user to a group of users based on the baseline profile at **450**. For example, the recommendation system can identify a group of users that have accomplished the goal or objective and one or more behaviors associated with users in the group and/or actions performed by users in the group. In another example, the recommendation system can identify a group of users that have failed to accomplish the goal or objective and one or more user behaviors associated with users in the group and/or actions performed by users in the group. The recommendation system can then correlate particular behaviors and/or actions with the goal for the user.

In some implementations, the recommendation system can use machine learning techniques to identify and cluster similar user profiles. For example, the recommendation system can use machine learning techniques to determine which group profile is most similar to the baseline profile associated with the user and, in response, can place the user into the group associated with that group profile. In another example, the recommendation system can use machine learning techniques to determine which group profile includes users having user devices that are similar to the user of the user device and includes users interested in attaining the same objective. In yet another example, the recommendation system can use machine learning techniques to determine which group profile has sub-profiles that include common features to the sub-profiles that form the overall baseline profile of the user. It should be noted that any suitable machine learning technique can be used, such as a support vector machine, a decision tree, a Bayesian model, etc.

It should be noted that, in some implementations, other information can be used to group similar users together. For example, the group of users can include users having user devices that are in a similar geographic proximity, such as users that are in the same city as a particular user. As another example, the group of users can include users that are connected to each other on one or more social networking services.

It should also be noted that, in some implementations, process **400** can return to **420**, where the recommendation system can determine one or more goals for achieving a particular objective based on the assigned group of users. For example, for a particular objective, the recommendation system can retrieve one or more goals that are associated with an assigned group of similar users that have indicated a desire to reach the objective. In another example, for a particular objective, the recommendation system can rank the goals associated with an objective, where the ranking is based on inputs from users in the group of users as to which goals assisted the user in reaching the objective. The recommendation system can then select at least a portion of the goals for the user that may assist the user in reaching the objective. The selected goals can then be presented to the user in a recommendation interface, such as recommendation interface **800** shown in FIG. **8**. In this example, the recommendation system can provide the user of mobile device **500** with an opportunity to remove and/or add additional goals.

In some implementations, the recommendation system can use the baseline profile generated at **450** for other determinations. For example, the recommendation system can determine whether a current profile that includes updated data relating to the user from multiple data sources deviates from the previously generated baseline profile. Deviations between the baseline profile and the current profile can include, for example, a comparison of the frequency of particular activities (e.g., exercise frequency) and a comparison of the timing information relating to particular behaviors (e.g., the time when the user wakes up each day). Such a deviation can indicate that the data or such determinations based on the data may not be indicative of the emotional state of the user (e.g., a stress response may be detected from the user in response to a job change). Such a deviation can also indicate that the recommendation system is to update the baseline profile and/or update the assignment of the user into another group of users (e.g., as the user is progressing towards a goal or objective, as the behaviors of the user have changed over time, etc.). In another example, such a deviation can indicate that the recommendation system is to recommend actions that may return the user back to the baseline profile.

In a more particular example, the baseline profile generated by the recommendation system can include behaviors and/or activities associated with the user (e.g., consuming classical music, attending a fitness session, etc.), timing information relating to each of the behaviors and/or activities (e.g., time spent listening to classical music), frequency of a particular behavior and/or activity over a given time period (e.g., the number of times the user using the user device has listened to classical music during the week), threshold values associated with behaviors and/or activities (e.g., the user tends to listen to classical music at least three times a week for at least thirty minutes each session), etc.

In another more particular example, the baseline profile generated by the recommendation system can include any suitable representation of data related to the user. For example, in response to receiving a particular portion of biometric data, the recommendation system can determine an average heart rate for the user while at the office, an average number of calories burned on weekdays, and an activity curve for an average day for the user.

It should also be noted that multiple baseline profiles can be generated and associated with the user of the user device. For example, the recommendation system can generate a baseline profile using a first subset of data that is associated with a goal (e.g., getting at least thirty minutes of exercise per day) and another baseline profile using a second subset of data that is associated with another goal (e.g., using an email application for less than a particular amount of time). In another example, the recommendation system can generate a baseline profile in a particular context, such as "work," and another baseline profile in another context, such as "vacation."

In some implementations, the recommendation system can generate a target profile based on the assigned group, the goals, and/or the objective at **470**. For example, for a particular objective, the recommendation system can identify and cluster user profiles of users where it has been determined that the user has met a goal or an objective. In another example, the recommendation system can identify and cluster user profiles of users where it has been determined that the user has not met a goal or an objective (e.g., to determine which actions may not be assisting users in meeting a particular goal or objective). In yet another example, the recommendation system can identify and cluster user profiles of users that the recommendation system has previously assisted the users in attaining a stated goal or objective.

In a more particular example, the recommendation system can generate a target profile for achieving a particular goal or objective using a profile that includes information relating

to users that have met the particular goal or objective and information relating to users that have not met the particular goal or objective. In this example, the recommendation system can determine actions, threshold values, and other information that may assist the user in attaining the particular goal or objective—e.g., users that have been determined to achieve the objective of losing ten pounds in a month have also walked at least one mile each day, woken up by 6 AM in the morning, listened to classical music in the evening, and eaten meals at particular times. By, for example, determining common features between users that have indicated an achievement of the particular goal or objective, the recommendation system can generate a target profile that can be used to recommend actions to the user. These actions, if performed, may affect the current profile of the user such that the current profile of the user moves towards the target profile.

Referring back to FIG. **4**, in some implementations, the recommendation system can generate a current profile for the user based on updated data from the multiple data sources at **480**. It should be noted that the baseline profile and the current profile associated with the user can be dynamic profiles that can be generated using updated data from the multiple data sources. For example, in response to determining that a particular period of time has elapsed (e.g., one minute, one day, etc.), the recommendation system can receive and/or request updated data from the multiple data sources and generate a current profile for the user. Alternatively, the recommendation system can continue to use the baseline profile.

In some implementations, the recommendation system can compare the current profile with the target profile to determine a recommended action at **490**. This may, for example, impact the physical or emotional state of the user. Based on the objective or goal and the profile information, the recommendation system can determine which computerized action is to be executed at the user device, a device that the user possesses, or a device that is proximate to the user device.

In some implementations, the recommendation system can determine multiple computerized actions that are recommended to the user of the user device at various times. For example, the recommendation system can determine that a user has the particular objective of getting more exercise during the course of the user's workday. In response to receiving authorization from the user of a user device to access social networking data from a social networking service, location data from a mobile device associated with the user, and calendar data from an online calendar associated with the user, the recommendation system can determine that the user is currently feeling a relatively low energy from the social data and that the user has a meeting that is scheduled at a particular time and that is taking place at a particular location from the calendar data (with no obligations between the current time and the time of the meeting). The recommendation system can use such data and incorporate other data into a dynamic user profile. For example, based on biometric data from a wearable pedometer associated with the user, the recommendation system can determine the amount of activity that the user has engaged in that month to date or week to date and determine whether the user is likely to meet an indicated objective or goal or likely to meet an average activity level. In another example, based on location information, the recommendation system can determine the frequency that the user uses a car service to attend meetings at a particular location that is ten blocks away from a work location associated with the user. In yet another example, based on stated interests and/or affinities on a social networking service, the recommendation system can determine that the user of the user device likes flowers. In a further example, using mapping data, the recommendation system can determine a route between the work location associated with the user and the location of the meeting. Taking into account these portions of data from multiple data sources, the recommendation system can generate a current profile associated with the user and compare it with a target profile that can be associated with the particular objective and/or with a particular group of users. Based on the comparison, the recommendation system can cause one or more recommended actions to be executed, such as a notification that prompts the user to purchase a cup of coffee from a nearby coffee shop in five minutes, a notification that prompts the user to walk to the meeting using a particular route that includes an option to visit an orchid shop that recently opened in a location that is along the provided route. Alternatively, the recommendation system can, a particular time prior to the meeting, cause a scent generator located in proximity of the user device to emit a lavender scent. In another alternative example, the recommendation system, at a particular time prior to the meeting, determine the weather in proximity of the user device prior to causing a notification that prompts the user to walk to the meeting using a particular route as identified by a computer map route service, such as Google Maps (e.g., upon determining that the chance of precipitation is greater than a particular threshold value, upon determining that it is "too hot" for the user based on the determined temperature and user data as to what is considered "too hot," etc.).

Continuing with this example, the recommendation system can determine that the user has visited the orchid shop and/or that the user is walking to the coffee shop as recommended by the recommended action. The recommendation system can then use an application programming interface corresponding to the coffee shop to request the number of consumers in the coffee shop and can determine that the user may have a particular waiting time at the coffee shop. The recommendation system can, using its respective application programming interface, then determine that another coffee shop within the same franchise has a lesser waiting time and is nearby the user of the user device (e.g., a block away from the current location provided by the user device). The recommendation system can transmit an updated or revised recommended action to the user device.

It should be noted that each of these multiple computerized actions can be associated with a corresponding trigger event. For example, an action, such as the notification prompting the user to purchase coffee from a nearby coffee shop, can be triggered based on an associated time (e.g., time of day, time of the preceding event, time until the next scheduled event begins, etc.). In another example, an action, such as the notification prompting the user to visit an orchid shop along the route to a scheduled meeting, can be triggered based on location information associated with the user device (e.g., detecting that the user device is within a particular proximity of the orchid shop). In yet another example, the recommendation system can determine that the action is a message that is to be presented in a particular form (e.g., by email, text message, mobile notification, account notification, and/or in any other suitable manner) and/or at a particular time (e.g., based on the predicted emotional state of the user).

Referring back to FIG. **4**, the recommendation system can cause the recommended action or actions to be executed at **495**. Illustrative examples of recommended actions are

shown in FIG. **2**. As shown, the action or output can include, among other things, a haptic or touch sensitive feedback, a sensory feedback (e.g., image content, light cues, music, video messages, video content, etc.), an ambient-related feedback (e.g., causing a scent to be emitted from a suitable device, modifying a lighting scheme by a lighting or home automation system, etc.), and/or a content-related action (e.g., presenting text, image content, video content, audio content). In a more particular example, the recommended action can include modifying a sound, cancelling a sound, or enhancing a sound in the background of the user of the user device using an audio output device that is connected to the user device. In another more particular example, the recommended action can include providing sensory feedback (e.g., light cues, audio cues, video cues, scent cues, etc.) in the environment of the user of the user device to provide a notification. In yet another more particular example, the recommended action can include nostalgia-oriented feedback including content-related actions based on historical information relating to the user. In a further example, the recommended action can include a prioritization of application data based on device information and other information relating to the user (e.g., the organization of user interface elements, the positioning of documents or files, etc.).

In some implementations, the recommendation system can, based on the recommended action, identify one or more devices that may be connected to, or proximate to, the user of user device for executing the recommended action. In some implementations, the recommendation system can initiate device discovery functions to determine which device or devices are near the user device. In some implementations, such device discovery functions can be initiated in response to launching a recommendation application on the user device or in response to determining that a recommended action is to be executed using a device. Additionally or alternatively, in some implementations, such device discovery functions can be initiated from any suitable device and can use any suitable information to determine which devices are near the user device.

In some implementations, the user device can determine whether any output devices are nearby. The user device or the recommendation application executing on the user device can use any suitable technique or combination of techniques to determine whether any output devices are nearby. For example, the user device can transmit a signal or signals including a message requesting that nearby devices (e.g., devices which receive the signal) to respond with a message indicating that the device received the signal. In this example, the response can include any suitable device information, such as device location information and device capability information. As another example, the user device can receive a signal or signals transmitted by a device including a message indicating that the display device is available for causing a recommended action or output to be executed. Such signals can be transmitted using, for example, peer-to-peer communication techniques such as Bluetooth, using RFID techniques, and/or using any other suitable technique or combinations of techniques for communicating between the user device and one or more output devices.

In some implementations, the recommendation system can provide the user with the opportunity to select one or more output devices that are available for executing a recommended action. For example, as shown in FIG. **9**, recommendation interface **910** can provide the user with the opportunity to select, add, or remove various output devices that have been detected as being connected to or proximate mobile device **500**. As shown, such output devices can include a television device, a home automation system, a tablet computing device, a scent generator, and an automobile. In some implementations, the recommendation interface can provide the user with the opportunity to request that the user device detect additional output devices (e.g., in response to moving to a different location that is in the proximity of other devices).

In some implementations, the recommendation system can cause an output device to execute a particular action based on the physical or emotional state of the user. For example, prior to executing the particular action using the output device, the recommendation system can determine the current emotional state of the user and, upon determining that the emotional state of the user is "angry" based on user data, can inhibit the action from being executed on the output device. In another example, the recommendation system can determine that the particular action can be executed on the output device upon determining that the emotional state of the user is anything except for "angry"—e.g., as the recommendation system has determined from historical user data that actions taken by one or more output devices are not well received when the user is experiencing an "angry" emotional state.

Additionally or alternatively, in some implementations, the recommendation system can cause an output device to execute a particular action based on the predicted impact of the particular action on the current physical or emotional state of the user. For example, prior to executing a particular action using the output device, the recommendation system can determine the predicted impact of the action on the physical or emotional state of the user and, upon determining that the predicted impact is not within a particular range (e.g., the emotional state correlated with the user data remains unchanged), can inhibit the action from being executed on the output device.

As shown in FIG. **10** and in connection with the above-mentioned example, the recommendation system can present the user with a recommendation interface **1010** that includes multiple recommended actions. As shown, each recommended action that is presented in recommendation interface **1010** can include additional information for performing the recommended action, such as a map of a route in response to recommending that the user walk to the location of an event or commerce information in response to recommended that the user purchase a cup of coffee. As also shown, each recommended action can be associated with a particular time, such as purchasing a cup of coffee now or beginning a walk to the event at 1:45 PM. In some implementations, as described above, each recommended action in recommendation interface **1010** can be triggered by the occurrence of a particular event, such as a determination that the user device is associated with a particular location, a determination that the user device indicates the user is walking along a particular route, etc.

It should be noted that, in some implementations, a recommended action can be executed for multiple users. For example, as described above, the recommendation system can place the user of the user device into a group of users having a similar baseline profile. In addition, the recommendation system can place the user into a group of users based on other suitable criterion, such as others users having an established relationship with the user (e.g., based on social data from a social networking service) or others users that have a similar location profile as the user (e.g., family members, work colleagues, friends, etc.).

In this example, the recommendation system can identify one or more common actions within the group of users. The recommendation system can then select one or more of the actions that are to be executed for the group of users. In a more particular example, the recommendation system can select one or more common actions that are associated with a predetermined number of users (e.g., a majority of the users, a certain percentage of users in the group, etc.) and select one or more common actions that may affect the aggregated emotional state of the group of users. In another more particular example, the recommendation system can rank the common actions based on any suitable criterion and can then select a predetermined number of actions (e.g., top five) and designate them as group actions. In particular, the common actions can be ranked based on a deviation between a current profile associated with the user and a target profile so that the recommendation system can determine which actions have a higher likelihood of affecting the aggregated emotional state of the group of users. For example, a high rank can be assigned to a common action that is associated with a greater deviation between a current profile and a target profile.

For example, the recommendation system can determine an aggregated emotional state for a group of users and can then determine that the group of users or a threshold number of users within the group are located within the proximity of particular output devices. This can include determining that the location information associated with the users in the group of users is within a particular proximity and determining the output devices that are connected to or nearby the user devices associated with each of the co-located users. In a more particular example, the group actions can include any suitable actions that can be executed, such as presenting suitable media content (e.g., a playlist of music that may affect the aggregated emotional state of the group of users), adjusting ambient light in the surroundings of the group of users, adjusting ambient noises and scents in the surroundings of the group of users, etc.

Upon determining that the recommended action has been executed (e.g., the device presented a recommended action that included consuming content or performing a particular activity), the recommendation system can prompt the user of the user device to provide feedback to the recommendation system. For example, the recommendation system can receive feedback from the user indicating whether the recommended action was performed by the user, whether the recommended action may have impacted the emotional state of the user, and/or whether the action is to be recommended again to the user. As shown in FIG. **11**, the recommendation system can present an interface **1110** that prompts the user to provide feedback, such as an indication of the change in emotional state, an option to disable an output device, an indication as to whether the user performed a recommended action (e.g., confirming that the user walked to a meeting and visited a coffee shop along the way).

Additionally or alternatively, the recommendation system can obtain updated data, predict the current emotional state of the user and/or generate an updated profile, and determine whether the recommended action or actions may have moved the user towards one or more objectives.

In a more particular implementation, the recommendation system can determine whether a particular recommended action may have moved the user towards one or more objectives and/or goals. For example, the recommendation system can prompt the user to provide feedback (e.g., "How are you feeling now after getting a cup of coffee and watching that video?") in interface **1110** of FIG. **11**. In such an example, the recommendation system can receive feedback from the user relating to the particular recommended action. In another example, the recommendation system can select particular portions of data from multiple data streams and determine whether the data indicates that the recommended action may have moved the user towards one or more objectives. In such an example, in response to receiving authorization from a user of a user device to receive data relating to the user from multiple data sources, the recommendation system can select data from times subsequent to providing the recommended action and can determine that the social data and contextual data indicates the recommended action may have moved the user towards one or more objectives (e.g., the data indicates that the user is on track to attain a particular activity level).

In some implementations, any suitable rating can be associated with a recommended action. For example, such a rating can include a confidence value as to how much the recommendation system believes the recommended action may move the user towards one or more objectives. In this example, the recommendation system can begin with an initial confidence value that is incremented or decremented based on feedback from one or more users, where the rating can be increased in response to determining that a particular user has moved towards an objective after providing the recommended action. This increased rating can, for example, cause the recommended action to be provided to other users, such as users having the same or similar objectives, users placed in the same or similar groups as the user, etc. It should be noted that the rating can also include additional information, such as a difficulty value, a timeliness value, etc.

In some implementations, a current behavioral and/or emotional state of a user can be inferred based on characteristics of an entity or animate object present in the user's environment, and, in some implementations, the inferred behavioral and/or emotional state of the user can be used by the recommendation system to recommend a computerized action. In some implementations, the entity or animate object can include a user's pets (e.g., a dog, a cat, a rabbit, etc.), devices or appliances in the user's environment (e.g., a computer, a television, a refrigerator, etc.), and/or any other suitable object. In some implementations, data related to the entity or animate object can be received, for example, through microphones, cameras, and/or sensors present in the user's environment, and characteristics of the entity or animate object can be determined based on the received data. For example, in instances where the entity is a user's pet, the characteristics can include a mood of the pet (e.g., based on noises the pet is making recorded from a microphone or camera, recent movements of the pet based on a camera and/or a motion sensor, and/or based on any other suitable information). As another example, in instances where the entity is a device or appliance in the user's environment, the characteristics can include how recently the device or appliance has been used, how frequently the device or appliance has been used within a predetermined period of time (e.g., for one hour out of the last four, four times in the last hour, and/or any other suitable metric of frequency or duration), and/or any other suitable characteristics. In some implementations, a behavioral and/or emotional state of the user having a user device associated with the entity or animate object can then be inferred based on the determined characteristics. As a specific example, if it is determined that the user's dog is in an excited mood, it may be inferred that the user is also in a good mood. As another

specific example, if it is determined that the user's rabbit is frantically pacing, it may be inferred that the user is excited and/or nervous.

Turning to FIG. **12**, an example **1200** of a process for inferring a user's behavioral or emotional state based on characteristics of an entity or animate object in the user's environment is shown in accordance with some implementations of the disclose subject matter.

Process **1200** can begin by identifying an entity or animate object in the user's environment at **1210**. In some implementations, the entity or animate object can include a pet (e.g., a dog, a cat, a rabbit, etc.), a device or appliance (e.g., a television, a computer, a refrigerator, etc.), and/or any other suitable object, as described above. Process **1200** can identify the entity or animate object using any suitable information. For example, in some implementations, a user can explicitly specify entities and/or objects that process **1200** can identify, for example, using a user interface as shown in FIG. **13**.

Process **1200** can receive data related to the identified entity or animate object at **1220**. In some implementations, the data can be received from a device such as a video camera, a microphone, a motion sensor, and/or any other suitable device in the user's environment. In some implementations, the information can include a recording, for example, a video and/or an audio recording of any suitable duration (e.g., a second, two seconds, five seconds, a minute, and/or any other suitable duration). Additionally or alternatively, in some implementations, the data can include data from a sensor (e.g., a motion sensor, an accelerometer, a gyroscope, a light sensor, a thermometer, and/or any other suitable type of sensor). In some implementations, any suitable information related to the entity or animate object can be captured in the received data. For example, in instances where the entity or animate object corresponds to a pet, the data can include a video recording of the pet (e.g., from a video camera), an audio recording of the pet (e.g., from a microphone), data relating to the pet's movements (e.g., from a motion sensor, from a tag that has an accelerometer and/or a gyroscope, and/or from any other suitable source), and/or any other suitable information. As a more particular example, in some implementations, a pet's location and/or presence in a particular area can be determined based on a pressure gauge that can indicate altitude and/or height. In some such implementations, data from the pressure gauge can indicate any suitable information, such as a particular position of the pet (e.g., lying down, standing up, and/or any other suitable position), whether the pet is in a particular area (e.g., in the same room as a particular user device associated with the user, within a particular distance range of a user device associated with the user, and/or any other suitable area), and/or any other suitable information. In some implementations, data from a recording device and/or a sensor can be transmitted to a receiving device (e.g., a user device such as a tablet computer or mobile phone, a receiver, and/or any other suitable device) in any suitable manner (e.g., radio frequency (RF) communication, and/or any other suitable manner). As another example, in instances where the entity or animate object corresponds to a device or appliance, the data can include a video recording and/or an audio recording of the device in operation, data indicating a door associated with the appliance being opened or closed (e.g., from a motion sensor), and/or any other suitable information.

In some implementations, process **1200** can receive the recording and/or data using any suitable technique or combination of techniques. For example, in some implementations, process **1200** can identify available devices (e.g., an available video camera, an available microphone, an available sensor, etc.) using any suitable device discovery protocol(s) (e.g., "Discovery and Launch," and/or any other suitable protocol), and can associate with the identified device and/or request a recording and/or data from the identified device(s). As a more particular example, in some implementations, a first user device (e.g., a mobile phone, a tablet computer, and/or any other suitable device) can use a device discovery protocol to identify nearby devices (e.g., a nearby television, a nearby speaker, a nearby lighting source, and/or any other suitable device). In some such implementations, the first user device can cause identifiers (e.g., an IP address, a MAC address, a name of a manufacturer of the device, a user-specified name associated with the device, and/or any other suitable identifiers) of the discovered device to be stored (e.g., in one of server(s) **120**) for later use. As another example, in some implementations, process **1200** can receive a recording and/or data from a video camera and/or microphone associated with one or more known devices in the user's environment, for example, those specified explicitly by the user using a user interface such as that shown in FIG. **14**. As a more particular example, in some implementations, process **1200** can cause a microphone and/or a video camera of a known user device to being recording data. Note that, in some implementations, after receiving the recording and/or data, process **1200** can determine whether the recording and/or data contains information about the entity or animate object. As a specific example, if the entity or animate object corresponds to a user's pet and the received recording corresponds to a video recording from a video camera, process **1200** can analyze the video recording to determine if the user's pet appears in the recording.

Process **1200** can determine characteristics of the entity or animate object based on the received data at **1230**. For example, in instances where the entity or animate object is a user's pet, the characteristics can include a behavior of the pet, a mood of the pet, and/or any other suitable characteristic of the pet. As a more specific example, in instances where the entity is the user's pet dog, process **1200** can determine that the dog is likely excited and/or happy based on a determination that the dog's tail is wagging (e.g., based on a video recording from a video camera). As another more specific example, process **1200** can determine that the dog is likely anxious based on an analysis of an audio recording that contains the dog barking in a particular manner.

In instances where the entity or animate object corresponds to a device or an appliance (e.g., a television, a computer, a refrigerator, etc.), the characteristics can include how recently the device or appliance has been interacted with, the frequency or duration of interactions within a particular period of time, a manner of interaction, and/or any other suitable characteristics. For example, in instances where the device corresponds to a computer (e.g., a desktop computer, a tablet computer, a laptop computer, etc.), the characteristics can include that the computer was last used at a particular time (e.g., 1 p.m., two hours ago, and/or any other suitable time) and/or to perform a particular function (e.g., to begin streaming media content, to browse the Internet, and/or any other suitable function). As another example, in instances where the device corresponds to an appliance (e.g., a refrigerator, a washer/dryer, etc.), the characteristics can include a time a door associated with the appliance was last opened (e.g., based on data from a motion sensor), a time the appliance was last turned on, and/or any other suitable information.

Process **1200** can use any suitable technique or combination of techniques to determine characteristics of the entity or animate object based on the received data. For example, process **1200** can use any suitable image processing techniques (e.g., to process video data), audio processing techniques (e.g., to process audio data), machine learning techniques, statistical techniques, and/or any other suitable techniques. As a specific example, in instances where the entity or animate object corresponds to a user's dog, and the received data includes video data, process **1200** can use image processing techniques to identify particular parts of the dog (e.g., eyes, mouth, tongue, face, ears, tail, and/or any other suitable parts) and can calculate changes in the identified parts of the dog over multiple frames of the video data (e.g., to determine a motion of the dog's tail, to determine a facial expression, and/or to determine any other suitable characteristics). Furthermore, in some implementations, process **1200** can use any suitable machine learning techniques (e.g., a neural network, logistic regression, clustering, and/or any other suitable techniques) to infer a mood of the dog based on the video data and/or based on the identified parts of the dog (e.g., based on the dog's ears and/or ear movement, the dog's tail and/or tail movement, etc.). As another specific example, in instances where the entity or animate object corresponds to a user's pet rabbit, and the received data includes audio data, process **1200** can use audio processing techniques to identify particular sounds (e.g., teeth grinding, thumping, squealing, etc.). In some implementations, process **1200** can then use any suitable techniques to infer a mood of the rabbit based on the identified sounds. Continuing with this example, process **1200** may infer that the rabbit is happy based on an identification of teeth grinding sounds and/or infer that the rabbit is distressed based on an identification of squealing sounds.

Additionally, process **1200** can determine if the determined characteristics are anomalous, for example, based on a current time of day or current day of the week. As a specific example, if process **1200** determines that a current characteristic of the user's pet is that it is inactive or sleeping, process **1200** can determine if the user's pet is likely to be inactive or sleeping at similar times of day or similar days of the week. As another specific example, if process **1200** determines that a current characteristic of the user's pet is that it is excited, process **1200** can determine if the user's pet is likely to be excited at similar times of the day (e.g., at a time when the user typically returns home, at a time when the pet is typically taken outside, and/or any other suitable time). As yet another specific example, if the entity or animate object corresponds to an appliance, and the determined characteristics indicate that the appliance is currently in use, process **1200** can determine if the appliance is typically in use at the current time of day or the current day of the week. In some implementations, current and/or past characteristics corresponding to a particular entity or animate object can be stored in any particular manner. For example, in some implementations, information relating to entities and/or objects can be stored in one of server(s) **120**, and, in some implementations, process **1200** can query the server to receive past characteristics to determine if the current characteristics are anomalous. In some implementations, past characteristics can be stored for any suitable duration of time (e.g., a day, a week, a month, and/or any other suitable duration).

Process **1200** can correlate an emotional or behavioral state of the user with the determined characteristics of the entity or animate object at **1240**. For example, if the entity or animate object corresponds to the user's pet, and the characteristics determined at block **1230** indicate that the user's pet is likely to be in a good mood (e.g., based on the pet's movements and/or noises the pet is making), process **1200** may infer that the user is also likely to be in a good mood. Continuing with this example, if the characteristics determined at block **1230** indicate that the user's pet is likely not in a good mood (e.g., that the pet is anxious, distressed, sad, etc.), process **1200** may infer that the user is also likely not in a good mood. As another example, if the entity or animate object corresponds to the user's television or computer, and the characteristics determined at block **1230** indicate that media content has been presented for longer than a predetermined period of time (e.g., more than two hours, more than four hours, and/or any other suitable period of time), process **1200** may infer that the user is sick and/or tired. As yet another example, if the entity or animate object corresponds to an appliance in the user's environment (e.g., a washer/dryer, and/or any other suitable type of appliance), and the characteristics determined at block **1230** indicate that the appliance is being used (e.g., based on an indication that the appliance has been turned on, based on an indication that a door associated with the appliance has been opened more than a predetermined number of times, and/or based on any other suitable information), process **1200** may predict that the user is accomplishing a particular task (e.g., laundry, dishwashing, cooking a meal, and/or any other suitable task).

Note that, in some implementations, process **1200** can predict the emotional or behavioral state of the user based on whether the characteristic of the entity of object is anomalous for a current time of day or a current day of the week. As a specific example, if the determined characteristics associated with a user's pet indicate that the user's pet is sad and/or anxious at a time of day when the pet is not typically sad and/or anxious, process **1200** may determine that it is especially likely that the user is also sad and/or anxious. As another specific example, if the determined characteristics corresponding to a user's television indicate that the television has been on and presenting content for the past three hours, but process **1200** determines that the user typically watches three hours of television at the current time of day or the current day of the week, process **1200** may infer that the user is not sick.

Process **1200** can determine the emotional state or mood of the user based on the characteristics of the entity or animate object using any suitable technique or combination of techniques. For example, in some implementations, process **1200** can access a table that lists emotional state of the user based on determined characteristics of a user's pet. As a specific example, in some implementations, the characteristics of the user's pet can be mapped to one of a group of emotional states of the user's pet (e.g., "happy," "sad," "tired," "anxious," and/or any other suitable emotional states, which can then be used as keys in the table. After determining the emotional state of the user's pet, process **1200** can use the table to determine the likely corresponding emotional state or mood the user. Note that, in some implementations, a particular emotional state or characteristics of the entity or animate object can be mapped to multiple possible emotional states or moods of the user. In some such implementations, each of the possible emotional states or moods of the user can be associated with a weight, indicating a likelihood that the corresponding emotional state or mood maps to the characteristic of the entity or animate object. Furthermore, in such implementations, the weights can be updated based on feedback from the user, as described below.

Process **1200** can cause a recommended computerized service to be presented on a user device associated with the user based on the predicted emotional state or mood of the user at **1250**. For example, in instances where process **1200** inferred or predicted that the current emotional state or mood of the user associated with the user device is tired, process **1200** can cause a recommendation that the user visit a nearby coffee shop to be presented. As a more specific example, in some implementations, the recommendation can be presented in a user interface on the user device and can include directions to the coffee shop, an estimated travel time to the coffee shop, reviews of the coffee shop, and/or any other suitable information. As another example, in instances where process **1200** inferred or predicted that the current emotional state or mood of the user associated with the user device is frustrated, anxious, or otherwise upset, process **1200** can cause a recommendation that the user watch a particular television program or movie (e.g., a favorite program or movie, a program being broadcast on a favorite television station, and/or any other suitable program or movie) to be presented.

Process **1200** can determine the recommended computerized service to be presented using any suitable technique or combination of techniques. For example, in some implementations, process **1200** can access a table that lists recommended computerized services corresponding to different emotional states or moods. As a specific example, recommended computerized services corresponding to an emotional state of tired can include a presenting a recommendation to go to a nearby coffee shop, causing a particular type of music to be played, and/or any other suitable recommended service. As another specific example, recommended computerized services corresponding to an emotional state of angry or frustrated can include presenting a recommendation to call a friend, presenting a recommendation to view a particular television program or other media content, and/or any other suitable recommended service. In some implementations, a particular emotional state or mood of the user can be mapped to multiple possible recommended services. In some such implementations, each possible recommended service can be associated with a weight which can indicate a likelihood that the user will interact with and/or select the recommended service when presented. Furthermore, in some such implementations, the weight(s) can be updated based on user feedback after a presentation of a recommended service, as described below. Note that, in some implementations, the presentation of the recommended computerized service can be presented in connection with an indication of the determined characteristics associated with the entity or animate object. As a specific example, a recommendation to visit a particular coffee shop can be presented with an indication that the user may be tired, based on the determined characteristics of the user's pet.

Although not shown in FIG. **12**, in some implementations, process **1200** can update information used to determine a user's emotional state or mood based on characteristics of the entity or animate object and/or update information used to determine a recommended computerized service. For example, in some implementations, information can be updated based on information indicating a user's response to a presented recommendation. As a more particular example, in instances where the recommended computerized service includes presenting a suggestion to go to a particular location (e.g., a coffee shop, a library, a restaurant, a store, and/or any other suitable location), process **1200** can receive location information (e.g., GPS coordinates, a name of a city and/or town, and/or any other suitable location information) from a user device associated with the user to determine if the user went to the particular location. Continuing this example, if process **1200** determines that the user did not go to the particular location, process **1200** can update information used to determine the user's emotional state and/or used to determine the recommended service. As another more particular example, in in instances where the recommended computerized service includes presentation of a user interface, process **1200** can update the information based on the user's interaction with the user interface. As a specific example, if it is determined that the user interface was closed and/or dismissed (e.g., within a particular time period), process **1200** can determine that the particular recommended service should not be recommended again. As yet another more particular example, in some implementations, explicit feedback relating to a determination of a user's emotional state or mood and/or a presentation of a recommended service can be received directly from the user via a user interface. As a specific example, if a presented user interface suggests that a user visit a particular coffee shop, the user interface can include any suitable controls for allowing the user to indicate whether the suggestion was helpful and/or correct. In instances where the user feedback indicates that the determined emotional state and/or the presented recommended service were incorrect and/or unhelpful, process **1200** can update information used to determine the emotional state and/or the recommended service.

Process **1200** can update the information using any suitable technique or combination of techniques. For example, in some implementations, process **1200** can update entries of a table used to determine the user's emotional state and/or used to determine the recommended service. As a specific example, if a recommendation to go to a particular coffee shop was presented and it was determined (e.g., based on location information associated with a user device) that the user did not go to the coffee shop, the coffee shop can be removed from a table of recommended services. As another example, in some implementations process **1200** can update weights corresponding to one of more factors (e.g., image data, audio data, motion data, and/or any other suitable information) used to determine the user's emotional state and/or used to determine the recommended service.

Turning to FIG. **13**, an example **1300** of a user interface that can be used by a user to specify entities and/or objects that can be used to infer an emotional or behavioral state of the user in accordance with some implementations of the disclosed subject matter. As shown, in some implementations, user interface **1300** can include a collection of entities and/or objects **1310**. Examples of entities or objects that can be included in collection of entities or objects **1310** include a user's pets (e.g., a dog, a rabbit, a cat, etc.), devices (e.g., a desktop computer, a laptop computer, a tablet computer, a television, a stereo, and/or any other suitable type of device), and/or appliances (e.g., a washer/dryer, a refrigerator, and/or any other suitable type of appliance). In instances where objects listed in collection of entities or objects **1310** include devices or appliances, the devices or appliances can be discovered using any suitable device discovery protocol, for example, as described above in connection with FIG. **12**. In some implementations, a particular entity or animate object can be selected and/or deselected in any suitable manner, as shown in FIG. **13**. For example, a particular entity or animate object can be selected and/or deselected using checkboxes, radio buttons, drop-down menus, and/or any other suitable user interface control. In some implementa-

tions, information received from user interface **1300** can be stored, for example, on one of server(s) **120**.

Turning to FIG. **14**, an example **1400** of a user interface that can be used by a user to specify one or more sources of information that can be used to receive data associated with a particular entity or animate object is shown in accordance with some implementations of the disclosed subject matter. As shown, in some implementations, user interface **1400** can include collection of sources **1410**. Examples of sources of information include microphones, video cameras, sensors (e.g., a motion sensor, an accelerometer, a light sensor, and/or any other suitable type of sensor), and/or any other suitable sources of information. In some implementations, a particular source of information can be selected and/or deselected in any suitable manner. For example, a particular source of information can be selected and/or deselected using checkboxes, radio buttons, drop-down menus, and/or any other suitable user interface control. In some implementations, information received from user interface **1400** can be stored, for example, on one of server(s) **120**.

Accordingly, methods, systems, and media for recommending computerized services based on an animate object in the user's environment are provided.

Although the disclosed subject matter has been described and illustrated in the foregoing illustrative implementations, it is understood that the present disclosure has been made only by way of example, and that numerous changes in the details of implementation of the disclosed subject matter can be made without departing from the spirit and scope of the disclosed subject matter, which is limited only by the claims that follow. Features of the disclosed implementations can be combined and rearranged in various ways.

What is claimed is:

1. A method for recommending computerized services based on an animate object in the user's environment, comprising:

receiving a request from a user device to associate a recording device that captures motion data indicative of motion of a pet within a predetermined distance range of the user device;

associating the user device with the recording device in response to receiving the request;

receiving the motion data from the recording device that is indicative of motion of the pet;

determining, using a hardware processor, an emotional state of the pet based on the received motion data;

determining whether the determined emotional state of the pet animate object is an anomalous emotional state for the pet at a current time of day;

in response to determining that the determined emotional state of the pet is an anomalous emotional state for the pet, correlating an emotional state of a user of the user device based on the anomalous emotional state associated with the pet; and

causing a recommended computerized service to be presented by the user device based on the emotional state of the user, wherein the recommended computerized service corresponds to a recommended action to be taken by the user of the user device, and wherein the recommended action is unrelated to the pet.

2. The method of claim **1**, wherein the recording device is a device having an accelerometer, and wherein the motion data is data received from the accelerometer.

3. The method of claim **1**, wherein the recording device is a camera, and wherein the motion data includes image data received from the camera.

4. The method of claim **1**, wherein correlating the emotional state of the user of the user device based on the determined emotional state associated with the pet further comprises accessing a table associated with the user device to determine the emotional state of the user.

5. The method of claim **1**, further comprising:

receiving, from the user device, information indicating a response to the presented recommended computerized service; and

updating information used to correlate the emotional state of the user of the user device based on the information indicating the response.

6. The method of claim **5**, wherein the information indicating the response includes location data associated with the user device.

7. The method of claim **5**, wherein the information indicating the response is received via a user interface.

8. A system for recommending computerized services based on an animate object in the user's environment, the system comprising:

a hardware processor that is programmed to:

receive a request from a user device to associate a recording device that captures motion data indicative of motion of a pet within a predetermined distance range of the user device;

associate the user device with the recording device in response to receiving the request;

receive the motion data from the recording device that is indicative of motion of the pet;

determine an emotional state of the pet based on the received motion data;

determine whether the determined emotional state of the pet animate object is an anomalous emotional state for the pet at a current time of day;

in response to determining that the determined emotional state of the pet animate object is an anomalous emotional state for the pet, correlating an emotional state of a user of the user device who is different from the animate object based on the anomalous emotional state associated with the pet; and

cause a recommended computerized service to be presented by the user device based on the emotional state of the user, wherein the recommended computerized service corresponds to a recommended action to be taken by the user of the user device, and wherein the recommended action is unrelated to the pet.

9. The system of claim **8**, wherein the recording device is a device having an accelerometer, and wherein the motion data is data received from the accelerometer.

10. The system of claim **8**, wherein the recording device is a camera, and wherein the motion data includes image data received from the camera.

11. The system of claim **8**, wherein the hardware processor is further programmed to access a table associated with the user device to determine the emotional state of the user.

12. The system of claim **8**, wherein the hardware processor is further programmed to:

receive, from the user device, information indicating a response to the presented recommended computerized service; and

update information used to correlate the emotional state of the user of the user device based on the information indicating the response.

13. The system of claim **12**, wherein the information indicating the response includes location data associated with the user device.

14. The system of claim 12, wherein the information indicating the response is received via a user interface.

15. A non-transitory computer-readable medium containing computer executable instructions that, when executed by a processor, cause the processor to perform a method for recommending computerized services based on an animate object in the user's environment, the method comprising:

receiving a request from a user device to associate a recording device that captures motion data indicative of motion of a pet within a predetermined distance range of the user device;

associating the user device with the recording device in response to receiving the request;

receiving the motion data from the recording device that is indicative of motion of the pet;

determining an emotional state of the pet based on the received motion data;

determining whether the determined emotional state of the pet is an anomalous emotional state for the pet at a current time of day;

in response to determining that the determined emotional state of the pet is an anomalous emotional state for the pet, correlating an emotional state of a user of the user device who is different from the animate object based on the anomalous emotional state associated with the pet; and

causing a recommended computerized service to be presented by the user device based on the emotional state of the user, wherein the recommended computerized service corresponds to a recommended action to be taken by the user of the user device, and wherein the recommended action is unrelated to the pet.

16. The non-transitory computer-readable medium of claim 15, wherein the recording device is a device having an accelerometer, and wherein the motion data is data received from the accelerometer.

17. The non-transitory computer-readable medium of claim 15, wherein the recording device is a camera, and wherein the motion data includes image data received from the camera.

18. The non-transitory computer-readable medium of claim 15, wherein correlating the emotional state of the user of the user device based on the determined emotional state associated with the pet further comprises accessing a table associated with the user device to determine the emotional state of the user.

19. The non-transitory computer-readable medium of claim 15, wherein the method further comprises:

receiving, from the user device, information indicating a response to the presented recommended computerized service; and

updating information used to correlate the emotional state of the user of the user device based on the information indicating the response.

20. The non-transitory computer-readable medium of claim 19, wherein the information indicating the response includes location data associated with the user device.

21. The non-transitory computer-readable medium of claim 19, wherein the information indicating the response is received via a user interface.

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